Concrete

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Good Jobs for Good Builders

By Harvey Whipple
Editor "Concrete".

THE future of the concrete house is that of *better* houses—that they be *cheap* is secondary—home owners are overburdened now with the upkeep of cheap houses.

There will be more concrete houses when more contractors know how to build them.

We are not especially in need of new methods, more methods, or even, generally speaking, better methods; we need builders who know how to use the methods now available.

There is a bigger demand—partly active and expressed and partly a potential demand—for concrete houses now than is being met by available builders familiar with the application of concrete to house construction. This magazine has many inquiries for concrete house builders. Many times we are unable to refer a prospect to a nearby builder who we are confident can handle a concrete house job.

Every builder bitten by the concrete house bug must somehow start at the beginning and devise a method of his own. The woods are full of methods. Each year contributes some worth-while ideas to the general store of our knowledge. Most new methods—"systems"—are used more or less successfully by those who originate them. The inventor knows all the ins and outs. He has spent days and nights working on the details. He invests two, five, ten, twenty thousand dollars in new dingafusses to mold concrete in place, or precast it in pieces—new forms, ties, spacers, hickeydoos. He sits up nights with his infant idea, nurses it, dreams about it, holds it on his knee at meals, and by the time it begins to stand erect on two legs, the fond parent declares his child is a world-beater. He pushes the child out into the world, and is surprised and grieved to find that others do not take it so seriously, nor have the patience that its parent had, with its peculiarities.

Concrete would not discourage the development of new housebuilding methods. There are many good features among the few bad of almost all of them. Some time the whole lot will be sifted and we shall then be able to standardize the good ideas. In the time saved from building up new systems we'll build a lot more houses.

This magazine would like to encourage the use and refinement of the methods we have. If a builder, feeling "the urge," would spend just a quarter of his money investigating and studying the methods that are now available, instead of spending all of his money in bringing forth a new system of his own and adding to the patent office congestion, we'd soon have more people living in concrete houses, and more contractors making money.

* * *

ANOTHER thing: why not stop talking about fireproof houses cheaper than wooden houses? The public doesn't believe it, even when it is true. This magazine has been guilty, because it is a clearing house for the available information on the subject. We believe that houses with concrete walls are *occasionally* built at a lower first cost than *first-class* wood frame houses. On most jobs there are a good many "ifs" and "excepts"—"If we had had a well-organized crew—;" "If we hadn't been breaking in new men every two days—;" "If we could have built five houses in one group at one set-up of our equipment—;" etc. We also believe that concrete houses will ultimately be cheaper in first cost than well-built frame houses—that will come with practice, standardization, organization, and the growing scarcity of good lumber.

In the main and for the present we believe that the concrete house is the lowest in cost over a ten-year period; that it is cheaper now in actual first cost than any other masonry house. We believe that a builder who organizes his crew and his operations carefully can build concrete houses and make the structural floors fireproof, as well as the walls, at a cost no greater than that of any other masonry construction with wooden floors.

THERE are three kinds of housebuilding enterprises from the contractor standpoint:

(1) The industrial development, which uses one, or at most only a few standardized plans.

(2) The suburban homes development, in which the building is financed and carried on by a single investor for individual buyers and employing a scheme of partial standardization of plans.

(3) The construction of individual houses on single home contracts for the great average citizen who is willing to pay something for individuality.

There are three principal ways in which to use concrete to meet these three kinds of home-building development:

(1) With small, standardized, factory-made units—block, brick, and structural tile. These are suitable and economical for the individual house, the suburban group, or the industrial village. Such units provide without doubt the most generally available means of using concrete in building houses. There is nothing in such construction that differs radically from the use of age-old methods of conventional masonry units, except in details which are peculiar to the particular unit employed. Some of the opportunities for such work are discussed by A. J. R. Curtis and by W. D. M. Allan in two articles in this issue. The small concrete unit may be employed in its refined form for finished exterior surfaces. Such walls require care in laying—good mason work. The small unit may also be employed as a rough unit to be faced with stucco or some other material—this is the biggest present opportunity.

(2) With special equipment suitable for building single dwellings, or groups, or whole villages, either with large precast units made at the site of the work, or with monolithic construction. In this class there is a great deal from which to choose, and a wide range in the initial outlay for the special molds, forms and equipment for moving and erecting the units or placing the concrete. If the work is to be large group enterprises, or if the contractor is prepared to invest in equipment whose cost is to be spread over many individual jobs in several seasons, he has many choices. If he wishes to get along with a minimum of equipment and devote himself to average individual jobs—an outfit that can be put on a small truck quickly—he has fewer choices, but still a first class opportunity.

(3) Then there are those systems of molds and forms and handling devices which are suited *only* to the big group enterprises—systems in which the original outlay for equipment is large, and for which the plant set-up costs are justified only by a score or more of houses.

* * *

THE individual house, with concrete walls and wood joist floors, should be considered as competing with masonry wall houses, of brick, hollow tile, or natural stone.

In group developments careful organization and standardization of parts and operations make possible such economies with concrete as to make it lower in cost under most conditions than any other construction equally solid, permanent and fireproof.

Masonry walls, however, do not make fireproof houses. Most fires start inside. Furthermore, when concrete walls are tied together with reinforced concrete floors, the result in solidity and permanence is increased all out of proportion to the additional cost.

Slowly but surely is sentiment growing for better homes. Slowly but surely is the public seeing the unwisdom of building of materials that shrink, warp, burn, and decay.

The concrete builder's promotional efforts should not at this time be directed at building cheap houses. He should cultivate his trade among those who want the best. Progress in such things is not from the bottom up, but from the top down. Pat O'Grady's ambition is to build a house like Mr. Stocks-and-Bonds'—the rule does not apply the other way around. Build fireproof concrete houses for the people who want and can afford the best, and when you have your work more fully developed and better organized, you can show the average man why he can't afford to build a house that has a big repair program always under way.

Keep your mind on the idea of building fireproof houses for the great average citizen, but build *now* for the man who is willing to pay for the best.

Talk quality—give quality.

A New Kind of Cement Gun House

A new application of the Cement Gun to house construction has been developed in Boston, and employed in the construction of one two-family dwelling, by H. Whittemore Brown.

The new features are in the use of very light-weight wooden form panels made like shallow boxes, of story height—the sides of the boxes when spaced 4 to 6 in. apart providing a space in which a stud is poured, temporary front and back boards being used to complete the stud form. The bottoms of the box-like panels, which, when erected, provide the exterior plaster surface, are made of lath covered with jute bagging. Metal mesh is stretched on after forms for one story are erected, and on this, against the bagging, the gunite is "shot." Similar panel boxes are used for floors, with reinforced beams cast between, supporting a light floor slab of Nailcode concrete, on which the wood floors are nailed down. The light form units remain in the structure as a base for interior lath and plaster and for grounds. The job being completed at this time in Boston is workmanlike and was of such a character as to be given the prompt approval of the building authorities. The system is advanced as having special possibilities for economical development by the standardization of the form system and factory production of the form units by special box making machinery.

The February issue of CONCRETE will have a varied appeal—

The annual review of progress in design and construction methods for concrete Road Building

The first of an important series of articles on: Form Work for Concrete Building Construction from A to Z

The second of Mr. Curtis' articles on the best adaptation of block and other small precast units to House Construction

Several interesting articles on concrete houses

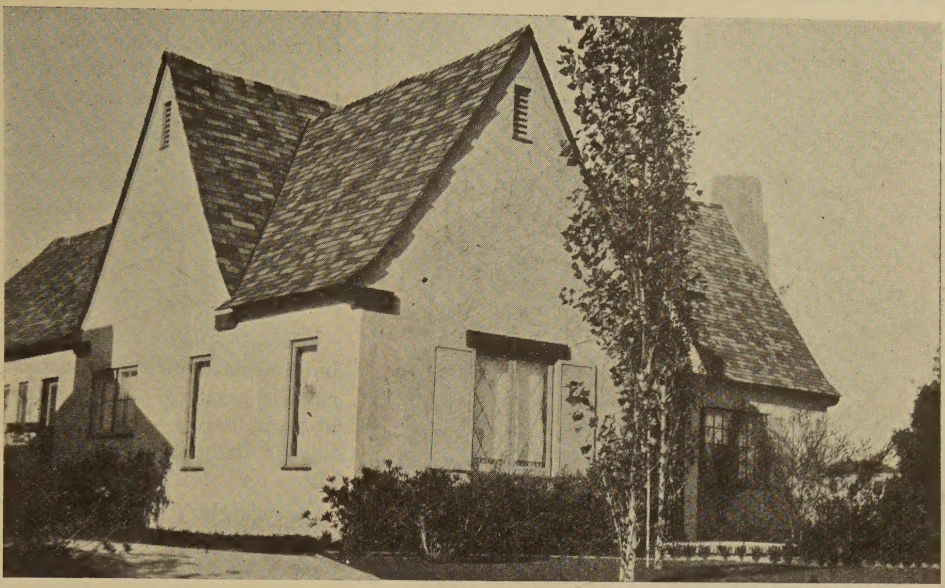


FIG. 2 — ATTRACTIVE PLANTINGS FURNISH PLENTY OF INTEREST FOR PLAIN STUCCO WALLS — A ROUGH-FLOATED SURFACE, AFTER THE SPANISH METHOD, AND QUAINT ARCHITECTURAL LINES, ARE HELPED CONSIDERABLY BY VARI-COLORED CEMENT ASBESTOS SHINGLES

How Shall We Build Our Concrete Houses?—The Small Unit

BY A. J. R. CURTIS
PORTLAND CEMENT ASSOCIATION

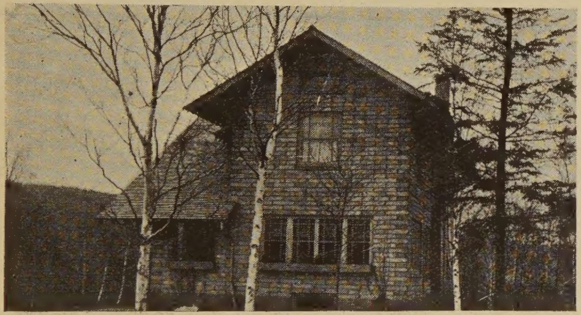


FIG. 1—THE SWISS TYPE OF ARCHITECTURE, WITH PLAIN FACE CONCRETE BLOCK—A DULUTH HOUSE—DEAN AND DEAN, CHICAGO, ARCHITECTS

There are two broad considerations applying to the house structure: (1) the materials to be used, and (2) the manner of their use. An inferior material well used may make a respectable showing, while an excellent material poorly used may fail utterly. The popularizing of concrete block houses, which are almost everywhere in competition with brick, stucco and frame, requires a much more intelligent and refined use of the material than has been generally found in the past.

COST NOT DETERMINING FACTOR

Contrary to general opinion, cost is not the determining factor in the selection of the wall material for individually built houses. The cost of good walls of concrete or masonry usually does not vary greatly under general conditions, and, as compared to the cost of the finished building, this difference in the cost of the walls is insignificant. If, for example, the cost of concrete block walls varies 10% from the cost of brick, and the completed walls represent 15% to 20% of the cost of the building, then the choice of one or the other of these types would only affect the total cost of the building to the extent of 1½% to 2%. On an $8,000 house this would amount to between $120 and $160.

A given wall material is usually selected because of (a) owner's choice as to appearance, or owner's supposition of a saving in cost, (b) architect's and contractor's familiarity with the material, (c) availability, and (d) considerations of permanence, low maintenance and fire protection. The insurance rate has very little to do with it as insurance on all types is comparatively cheap. A $10,000 five-year policy in the vicinity of Chicago costs $72 for high class brick or concrete block construction, and $86.50 for the poorest types of brick or block that are insurable. The difference is less than $3 per year on $10,000 worth of insurance.

APPEARANCE WILL SELL THE HOUSES

Concrete block houses must be built to appeal from the standpoint of appearance, even more than for permanence, low maintenance and fire safeness; architects and contractors must be fully informed as to approved methods of use, and block of a quality meting the public expectations must be locally available everywhere.

The block manufacturer who is out after house business might just as well kiss the dear old rock face block "goodby" now as to let the obsequies become long-drawn out and painful. Say what you will for rock faced, panel and most other special designs, they are down and out so far as good houses are concerned, and the successful builders of concrete block houses from now on will use the flat, granite faced block, or perhaps more generally the plain rough faced or "stucco" block, as a base for stucco.

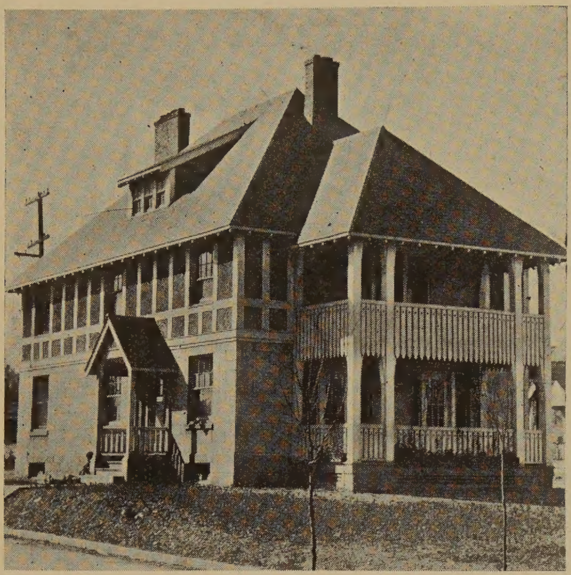
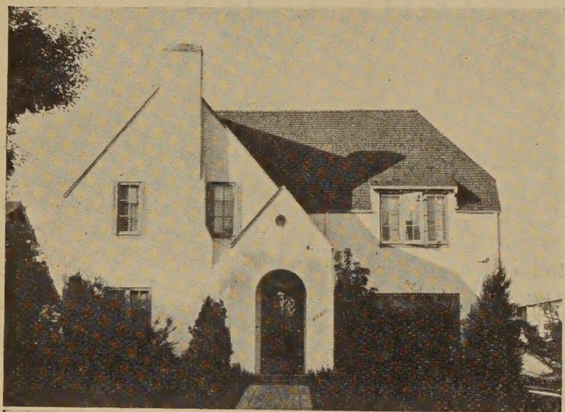


Fig. 3—Combination of Granite-Faced Concrete Block, Half Timbered Portland Cement Stucco on Block and Gray Slate Roof, Is Harmonious and Dignified, as Shown by This Halifax House, from the Board of Ross and MacDonald, Architects, Montreal



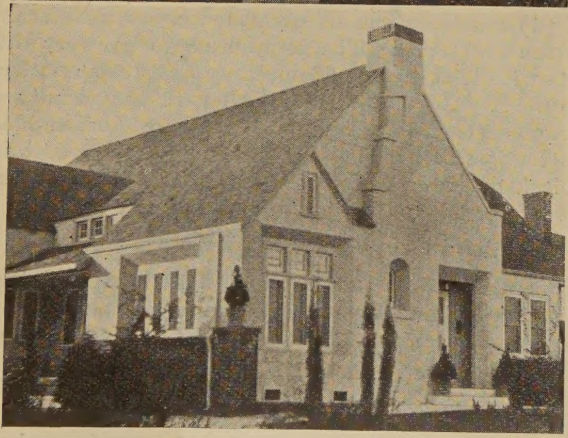


Fig. 4—Stucco-on-Block Construction Is Well Adapted to Simple English Dwelling Architecture—Portland Cement Stucco, on Good Masonry Base—Is Free from Cracks and Has Perfect Detail

Fig. 5—Smooth Marble and Granite Faced Block, with an Appropriate Use of Special Pieces Around Openings, Laid in White Portland Cement Mortar, Produces a Facing Which for Dignified Beauty Is Only Equaled by the Finest Marble and Granite

Although high grade granite surfaced block have the more distinctive appearance and get the architectural advantages of being able to break up the wall with attractive joints, the stucco surface is more popular with the average run of home buyers today; looks more usual, costs less and requires less skill to produce. The "stucco-block" type of house is what we recommmend the average block manufacturer-builder to advocate, for considering "talking points" and real value, owner's satisfaction, maintenance-free features and builder's profits, it is by far the most attractive type today.

Good Design and Good Details

Turning from the soap box and the house-that-Jack-built architecture of the past, the buyers of houses are rapidly acquiring a taste for the best of modern design in their houses. And why not architecture in the building of little houses? They make up the bulk of our cities and dot the landscape everywhere.

A straight tip to the builder of concrete block houses is to look well to his architecture, for he who builds the houses which are architecturally best will gain favor and accumulate glory for the type of house he builds. Make every concrete block house from this day forward architecturally beautiful and concrete block houses will soon dominate the map.

Most architects will design little houses, although few find such work profitable. However, there are many trustworthy sources of good plans. The Architects' Small House Service Bureau, Minneapolis (backed by the American Institute of Architects) furnishes plans for houses of block construction; plans are also available to builders through the Curtis Service Bureau, Clinton, Iowa, the Portland Cement Association, Chicago, and other sources. Concrete prints occasional plans, and will be glad to place every inquirer in touch with archi-

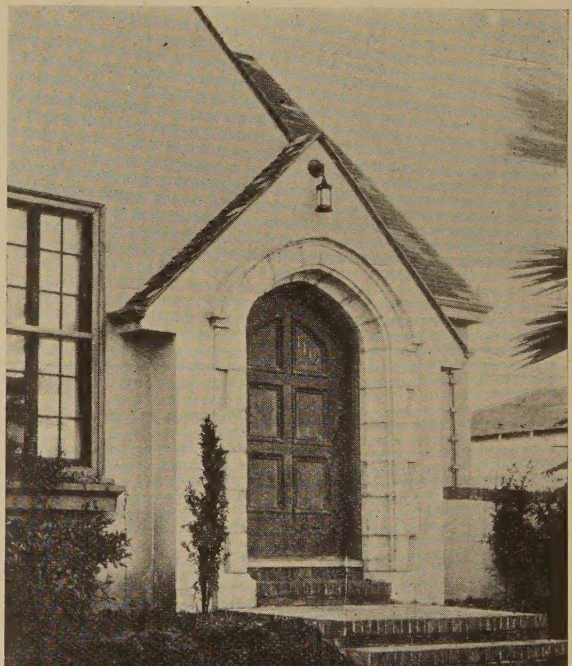


Fig. 6—In California Many Little Houses, with Stucco or Rough Concrete Surfaces, Have Beautified Art Stone Entrances as the Only Architectural Embellishment

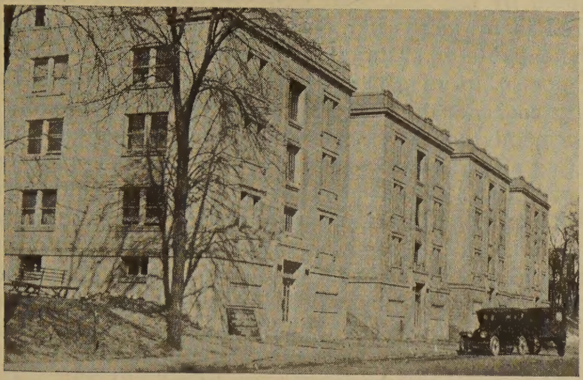
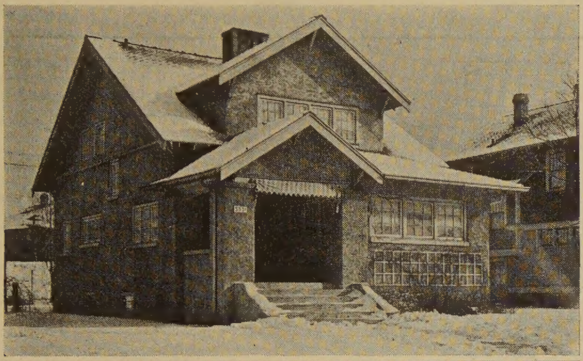


Fig. 7—This 96-Apartment Building Is One of 17 Such Structures in Omaha, Built Throughout with Granite-Surfaced Block, Except for Partition Walls, Which Are of Plain Block



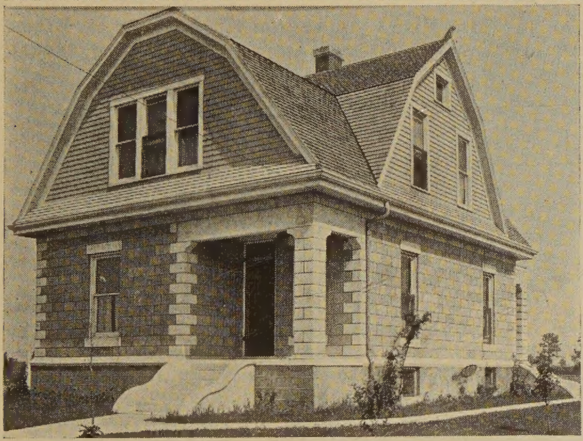


Fig. 8—Typical Bungalow in the Interesting Group Built by the Picabbs Method in Indianapolis—Several Courses of Concrete Tile Are Laid Up at a Time Without Mortar, the Interior Channels or "Grout Holes" Then Being Filled—These Are Independent of the Air Spaces—A Single Coat of Rough Cast Cement Stucco Is Applied to the Surface

Fig. 9—A Modern Farm Cottage with First Story Walls of Concrete Block, on the Farm of T. S. Nugen, Lewisville, Ind.—It Is Estimated That at Least 1,000,000 Farm Houses in Use at the Present Time Are Utterly Unfit to Live in, Indicating a Market for Millions of Block

tects competent to handle concrete house designs. Several of the accompanying illustrations constitute noteworthy examples of good architectural taste. They lead easily to the conclusion that when well designed, concrete is well adapted to fine residence construction.

The statement is often heard that "details make the house." One of the surest ways to bring the concrete house into quick favor is by perfection of the details. Even awkward or ugly design can sometimes be overlooked if the details are well attended to. While the arrangement of the floor space and the producing of pleasing elevations are matters purely architectural, and as such will be nicely cared for by architects, what the builders of concrete houses need most to do is to standardize details. There is need for the creation of a few standardized and highly efficient methods of fabricating block houses—eliminating the hundred and one devious and irregular schemes of individual builders.

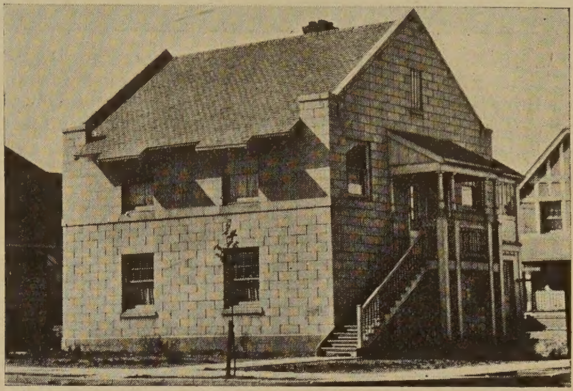
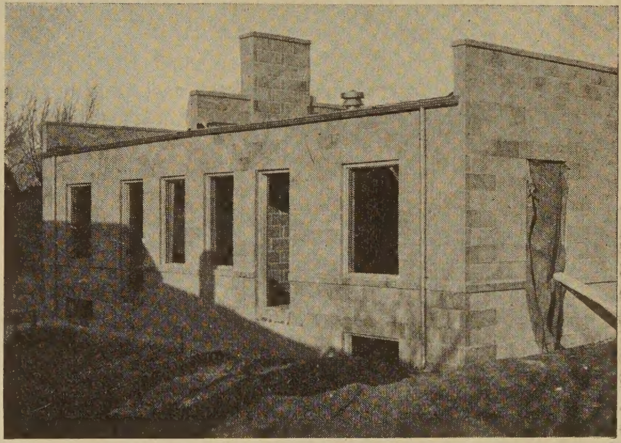


Fig. 10—A Small Two-Story Tenement in the Rebuilt Portion of Halifax—The Walls and Copings Are All of Granite-Faced Concrete Block

There must be one or two, or perhaps a few best ways of handling the details of concrete block house construction. Concerted effort is needed to discover these best methods and help them into general use.

[Suggestions for house details are described in an article scheduled to follow this one, and are the result of a



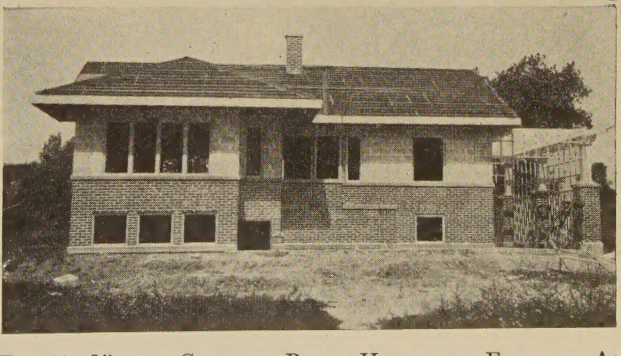


Fig. 11—Modern Concrete Block Houses are Faced on All Four Sides, an Obvious Architectural Advantage, as an Attractive Wall Surface Is Presented from Every Direction

Fig. 12—Concrete Block Bungalow Faced with Red Brick, Portland Cement Stucco and Concrete Art Stone—the Stucco Not Yet Applied

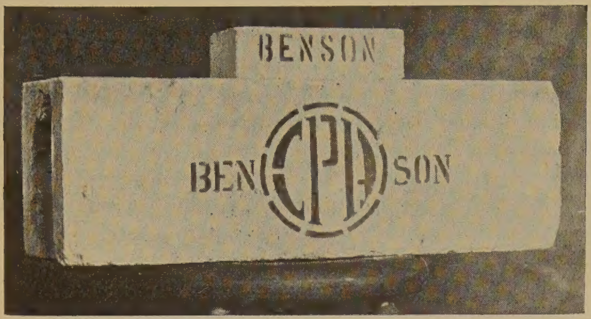


Fig. 13—Reliable Manufacturers of Concrete Block Have Taken More and More to the Idea of Marking or Branding Their Products as a Guarantee of Quality. The Block Shown was Manufactured by Newton J. Benson, Providence, R. I.

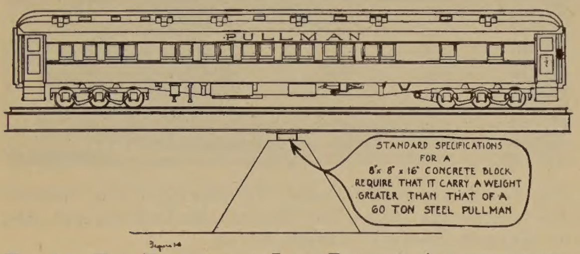

PULLMAN
STANDARD SPECIFICATIONS FOR A 8"x 8" x 16" CONCRETE BLOCK REQUIRE THAT IT CARRY A WEIGHT GREATER THAN THAT OF A 60 TON STEEL PULLMAN

Fig. 14—The Tremendous Load-Bearing Ability of the Ordinary Concrete Block, Seldom Recognized by the General Public, is Forcefully Illustrated by the Diagram

careful examination by Mr. Curtis of about 1,500 concrete block houses of many types throughout the United States and Canada.—Editor.]

Are the Concrete Block Structurally Acceptable for the Walls of Dwellings?

To answer the above question one must inquire from the viewpoint of load bearing ability, resistance to the passage of heat and cold, resistance to moisture and resistance to fire.

There is a standard specification for concrete block, adopted by the American Concrete Institute,[1] and concurred in by many city building codes, requiring block to be capable of sustaining a compression load of 1,000 lbs. per sq. in. of gross cross sectional area. It is generally conceded to be a fair requirement, reasonable in its demands on the manufacturer and at the same time meeting structural requirements with a conservative factor of safety. Translating this specification into terms which can be readily visualized, *every 8 x 8 x 16 in. concrete block which may be used legally in almost any American city today must be strong enough to support unaided, more than the entire weight of a 60-ton standard Pullman sleeping car.* That these requirements are being exceeded is shown by tests received frequently of which those tabulated (Table 1) in connection with this article are samples. The block made by the Beloit Concrete Stone Co., which, by the way, was taken at random out of stock, carried a compressive load of over 200 tons,

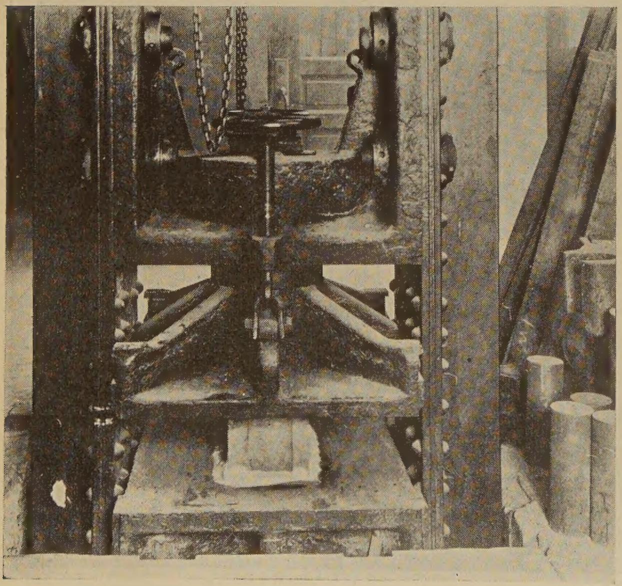


Fig. 15—Concrete Block, Embedded in Plaster of Paris and Cement Mortar Being Tested for Compressive Strength in the Materials Laboratories of the University of Wisconsin. Many Block Factories Have Their Product Tested Periodically for Their Own Information. Most Cities Require Frequent Tests

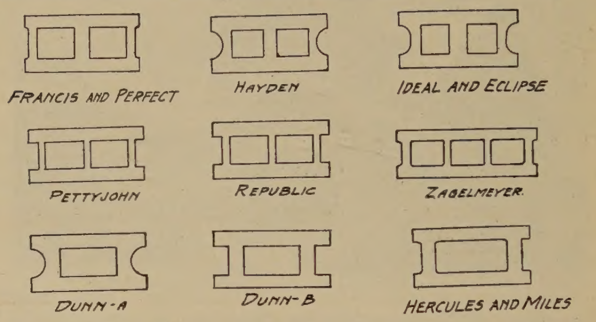


Fig. 16—The Rectangular Air Space Type of Block Are Used More Widely Than any Other General Type

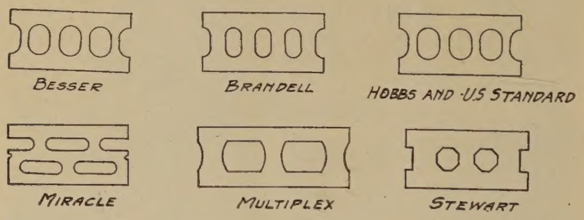


Fig. 17—The Block with Elliptical Air Spaces Are So Designed that Air Spaces in Succeeding Courses Match Up, Making Continuous Vertical Pilasters of the Block Webs—The Miracle Is the Only Double Staggered Air Space Block in Use in this Country Although it has Several Counterparts in Europe

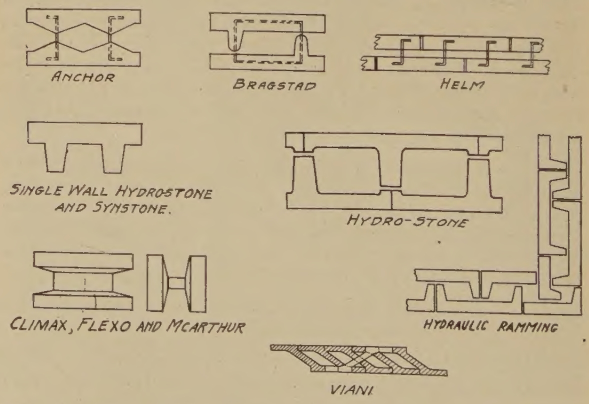

ANCHOR
BRAGSTAD
HELM
SINGLE WALL HYDROSTONE AND SYNSTONE.
HYDRO-STONE
CLIMAX, FLEXO AND MCARTHUR
HYDRAULIC RAMMING
VIANI

Fig. 18—The Three Double Wall Systems Shown in the Uppermost Row Make Use of Metal Connectors. Hydro-Stone and Hydraulic Ramming Double Wall Systems Have a Certain Similarity. These and the Climax, Flexo, McArthur and Viani All Make Use of Self-Contained Ties or Bonds

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[1] Copies available from the Secretary of the American Concrete Institute, New Telegraph Building, Detroit, Mich., and from the Portland Cement Association.

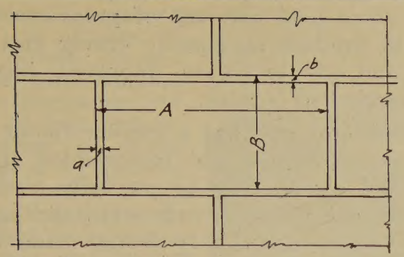


Fig. 19—The Lettered Dimensions Correspond Directly to the Dimensions Given in Table 2.

Table 1—Compression Tests on Concrete Block

Maker of Block	Beloit Concrete Stone Co., Beloit, Wis.	Connecticut Valley Concrete Products Assn., Springfield, Mass.
Where Tested	University of Wisconsin, Madison	Worchester Polytechnic Inst. Worcester, Mass.
How Tested	Hollow Spaces Vertical	Hollow Spaces Vertical
How Bedded	Plaster of Paris and cement	Plaster of Paris and cement
Height	7.9 inches	8 inches
Dimension Cross Section	8"x15¾"	
Gross Cross Sectional Area	126 sq. in.	
Net Cross Sectional Area		86.4 sq. in.
Ultimate Load (Lbs.)	402,700 Lb.	300,000 Lb.
Ultimate Load (Tons)	201.35 Tons	150 Tons
Ultimate Stress Gross Area	3196 Lb: sq. in.	[2]2344 Lb: sq. in.
Ultimate Stress Net Area	[1]4794 Lb: sq. in.	3470 Lb: sq. in.

[1] Assuming 33⅓% air space giving assumed net gross sectional area of 84 sq. inches.

[2] Assuming gross cross sectional area of 128 sq. inches.

Table 2—Dimensions of Concrete Block
(See Figure 19)

Block System (Double Rectangular Air Space Type)	A Total Length of Block, including Perpendicular Joint	a Thickness of Perpendicular and Horizontal Joints	B Total Height of Block, including Horizontal Joint	C Block Thickness
Eclipse	16 inches	¼ inch	8 inches	8, 10 & 12 in.
Francis	16 & 24	¼	8	8, 10 & 12
Hayden	16, 20 & 24	¼	8	8, 10 & 12
Ideal	16 & 24	¼	8	8, 10 & 12
Multiplex	20	⅜	6 & 8	8, 10 & 12
Perfect	16	¼	8	8
Pettyjohn	16, 20 & 24	¼	8	8
Republic	16	¼	8	8, 10 & 12
Stewart	16	¼	8	8 & 10
Waterloo-Perfection				
Zagelmeyer	16 & 24	⅝	8	8, 10 & 12
(Single Rectangular Air Spaces)				
Dunn	16	¼	8	8, 10 & 12
Hercules	16, 20 & 24	¼	8	8, 10 & 12
Miles	16	¼	8	8
(Elliptical Air Spaces)				
Besser	16	¼	8	8, 10 & 12
Brandell	16	¼	8	8, 10 & 12
Hobbs	16, 20 & 24	¼	6 to 12	8, 10 & 12
U. S. Standard				
(Double Wall Types)				
Anchor	16	5/16	8	8
Bragstad	24 inches	¼ inch	8 inches	10 inches
Climax				
Flexo				
Helm	24	¾	8	10
Hydraulic Ramming	24	H-¼ V-⅜	9	12
Hydrostone	24	⅜	9 & 12	8, 12 & 16
Viani	30		6 & 8	12
(Building Tile)				
Besser	12	¼	5	8 & 12
Blystone	12	¼	5	8 & 12
Eberling	12	¼	5	8, 12 & 16
Erickson	16	¼	6	8
Hy-Test	8, 10 & 12	¼	5	8
McIntyre	8, 10 & 12	¼	5	8 & 12
Picabbs (Adistile)	20	¼	4, 5 & 6	7 & 10

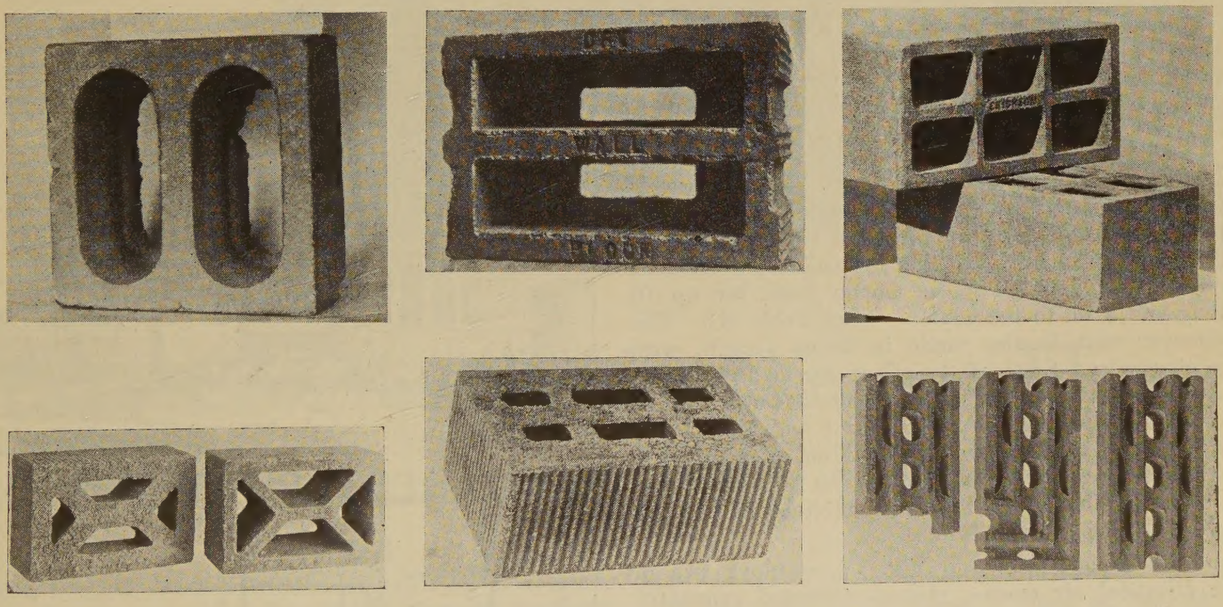


Fig. 20—The Light Weight Concrete Building Tiles—(Left to Right, Top) Besser, Blystone, Erickson; (Left to Right, Bottom) Hytest; McIntyre; Picabbs, or Adistyle

or the equivalent of 3 1/3 Pullman cars weighing 60 tons each. *This block actually carried a load greater than the weight of a large locomotive* and it was merely a specimen out of stock!

The reader who is impressed by these figures will be interested to know that whereas standard requirements for concrete block are fixed at 1,000 lbs., the comparable figure for a competing material—hollow clay tile—is only 700 lbs. per sq. in. on the gross area. The public usually gets the benefit of this difference in the shape of increased factor of safety, increased load bearing ability and increased rigidity. Comparable figures for brick vary as widely as to be difficult of comparison. The ordinary run of common brick will be found below standard block, while the better grades of face brick run higher. For comparable uses standard concrete block usually exceeds competing materials in bearing capacity, not mentioning the greater strength of cement mortar joints in concrete unit masonry (demonstrated beyond question in the comparative tests on concrete and clay brick columns at Columbia University, reported in Concrete for February, 1921).

In the absence of scientific data on heat losses through concrete block walls, it may be stated that in a canvass

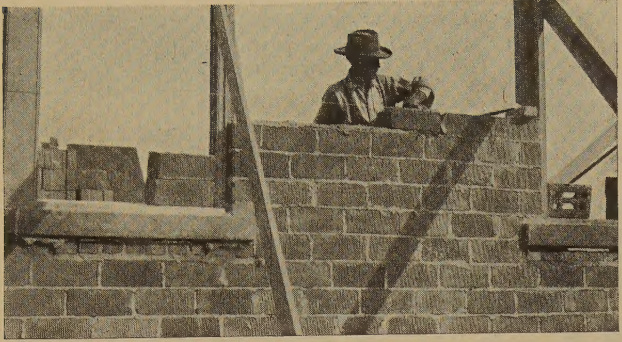


Fig. 21—Masons Lay the Light Weight Tile Very Rapidly, Handling the Tile with the Left Hand While Spreading the Mortar with the Right

of some 50 random concrete block houses in the Morgan Park project at Duluth, undertaken by the writer in January, 1920, not a single occupant reported any discomfort, any difficulty in heating nor excessive fuel consumption as compared with houses previously occupied. An accumulation of such evidence seems to indicate that concrete block walls introduce no new insulation problems if treated precisely as brick and other masonry walls under similar conditions.

When given either a dense surface finish or covered with portland cement stucco, any block having sufficient strength to pass standard requirements will prove absolutely water resistant; where the walls are not covered with stucco, the joints must be reasonably well executed, but this requirement is in no respect different from that for all masonry, except that in concrete block work the quantity of joints is reduced to a minimum.

That the fire underwriters believe in the ability of reasonably good block to withstand fire, is shown by the frequency with which they have recently given block residences a rate as low as $2.40 per $1,000 per year.

Various Available Systems of Block

The most widely used type of block has one, two or three self-contained air spaces of modified rectangular shape multiple openings, running the long way of the block, as shown in Fig. 16. All are made in dimensions which, with a ¼-in. or ⅜-in. mortar joint lay up 16 in. long and 8 in. to the course. (See Table B.) The Zagelmeyer unit is also made in 24-in. length, with three air spaces. Some of the others are made in 20-in. and 24-in. lengths. All of the systems shown in Fig. 16 are made to produce block for 8, 10 and 12-in. wall widths. The air space area varies from 27% to 35% for these block, and the weight of the 8 x 8 x 16-in. unit from 50 lbs. to 58 lbs., with mixture of average weight (140 lbs. per cu. ft.).

Another group, shown in Fig. 17, employs two or three elliptical air spaces, always arranged symmetrically so that continuous air spaces, from bottom to top of wall, are provided. The percentage of air space varies within about the same range as for the rectangular air space block.

Fig. 18 illustrates a number of double wall types. The three systems in the upper row make use of metal ties. Of these, the Helm system places the ties in the mortar joints. The Hydro-Stone and Hydraulic Ramming systems have considerable similarity, using concrete bonds, as do other systems shown.

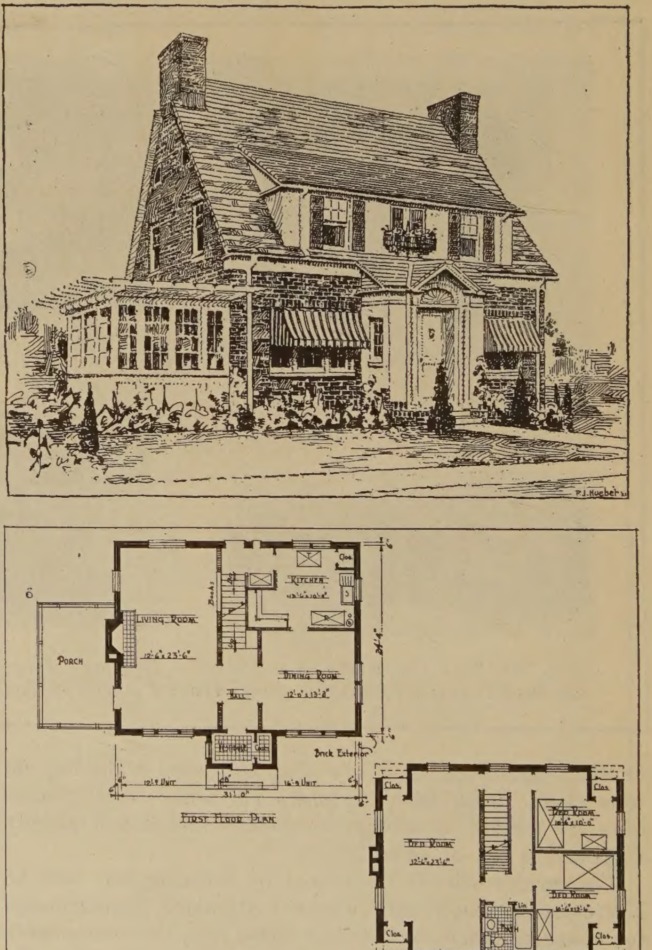
Concrete Light Weight Tile

Concrete light weight building tile, introduced quite generally during the last two years, constitute a development of the block in three important aims: (1) to create a lighter weight unit capable of sustaining practically equal load per unit of gross cross sectional area; (2) to produce an equally strong unit with less aggregate, and (3) to secure improved insulation by means of larger air spaces.

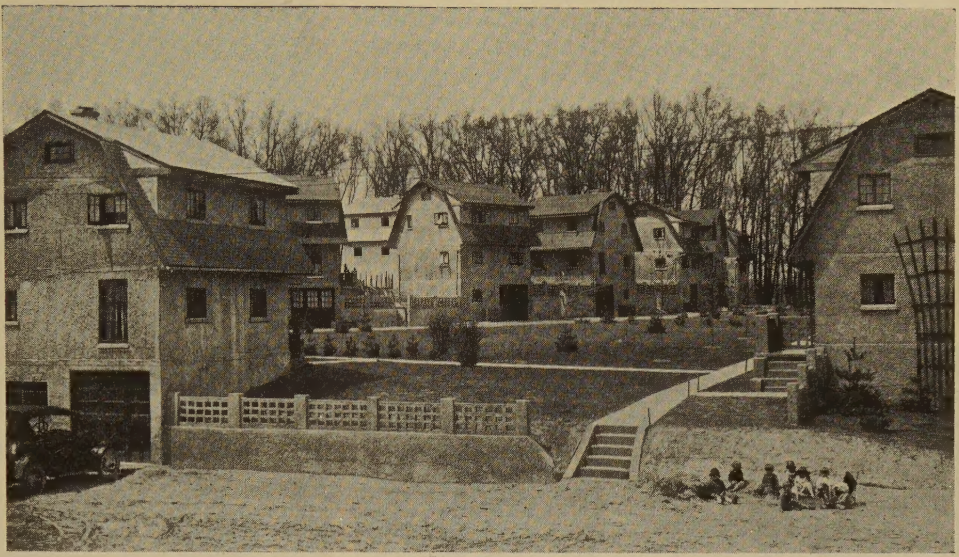
The light-weight unit has a smaller factor of safety so far as web thickness and compression stresses are concerned, and should only be carefully made of rich, well proportioned mixtures, well cured and aged before marketing. Block of ordinary design made with equal care can be expected to produce equally high net unit strength, which means much greater gross unit strengths.

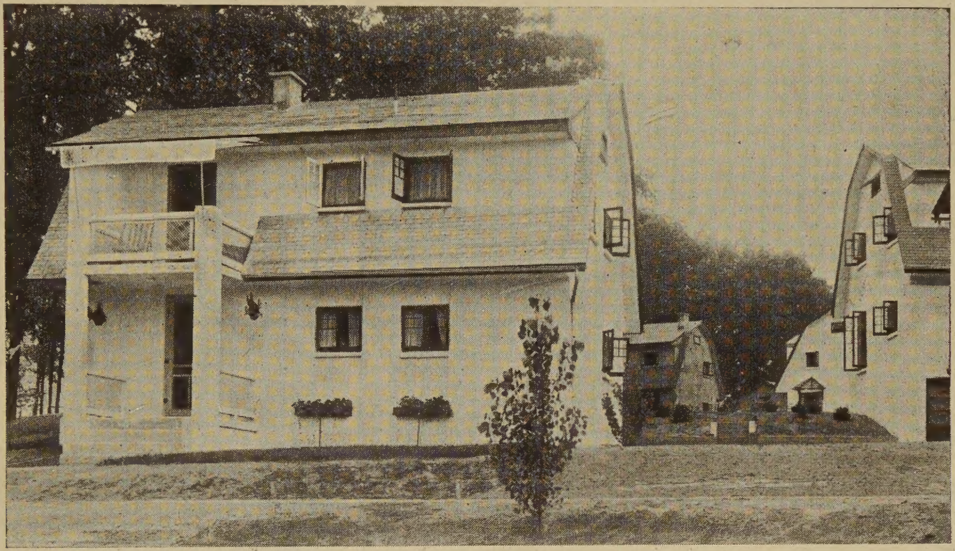
The light-weight unit is well adapted for the bearing walls of bungalows and other buildings of moderate height carrying relatively light floor loads. It is also an excellent partition unit, and will be much in demand for curtain wall work. Fig. 20 illustrates the important tile systems, and Fig. 21 is to show the speed with which light-weight tile go into the wall.

[Mr. Curtis is conservative in his estimate of light-weight units. If by making light units of better concrete, the load carrying capacity per unit of gross area is not decreased, such units seem to have even a larger field of usefulness than Mr. Curtis attributes to them. If we are going to continue to demand block that will support the weight of a Pullman car, for walls of two-story dwellings; then by making as good concrete as the man in Beloit (see Table 1) the light-weight units will be ample.—Editor.]



A Hueber System House with Reinforced Concrete Walls and Floors—See Elsewhere in This Issue





REINFORCED CONCRETE WALLS AND FLOORS IN $4,000 HOUSES BEING BUILT BY KATE GLEASON AT EAST ROCHESTER—100 HOUSES IN THE DEVELOPMENT—MOST OF THEM FINISHED OR UNDER WAY—EVERY HOUSE SOLD (AT PROFIT) BEFORE COMPLETION—THE METROPOLITAN LIFE INSURANCE COMPANY THOUGHT WELL ENOUGH OF THE WORK TO SUPPLY MORTGAGE MONEY—FIG. 1 (TOP)—THE FIRST HOUSES BUILT—3 STORIES INCLUDING BASEMENT AT GRADE ON THE LOWER STREET—THIS IS THE SO-CALLED "HILL-CLIMBER" HOUSE—FIG. 2—THE RECENT HOUSES ARE TWO STORIES HIGH AND LARGER IN PLAN

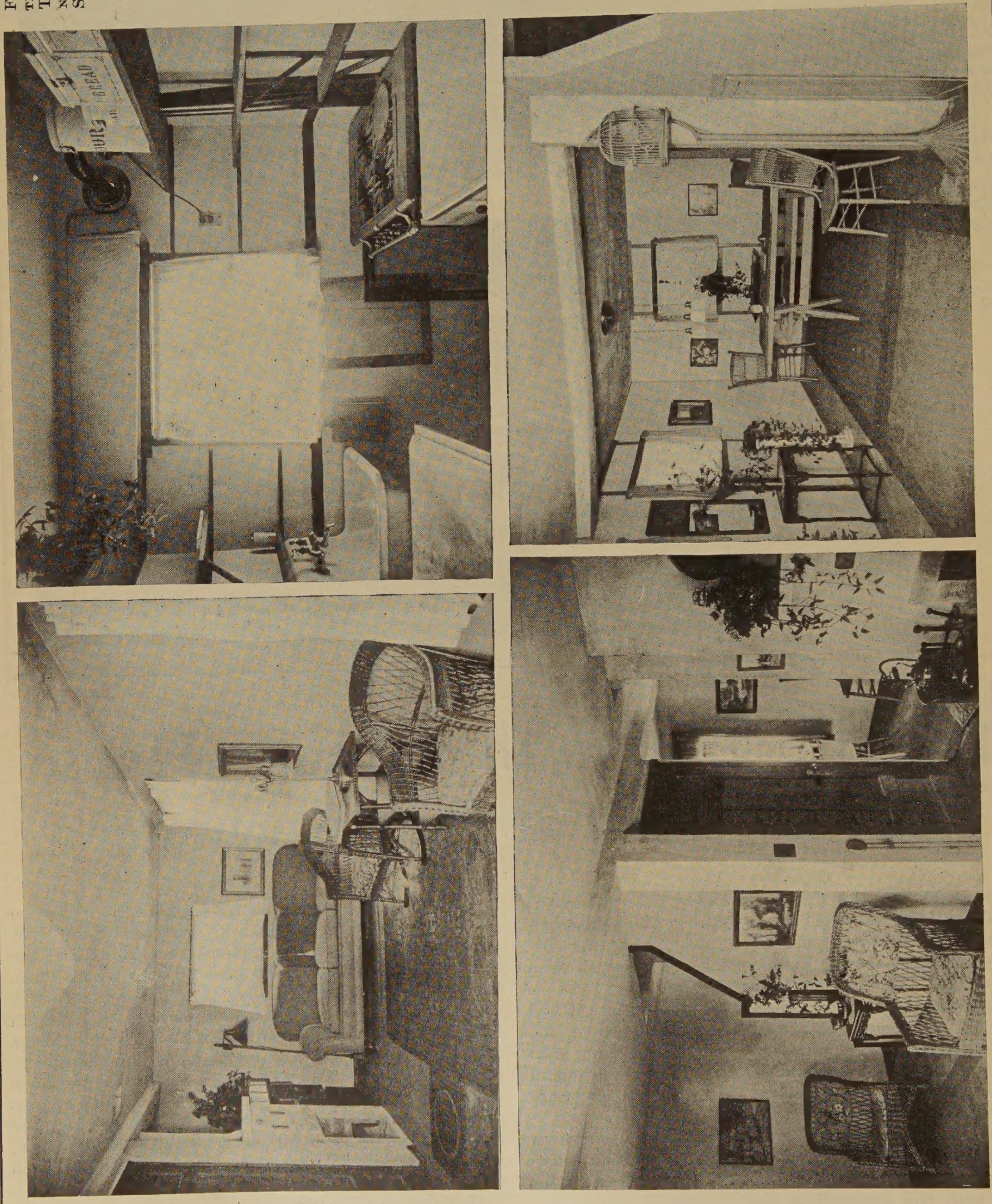
1921 Progress in the Gleason House Development at East Rochester

The work of Miss Kate Gleason, at East Rochester, N. Y., building small concrete houses to tempt discriminating buyers away from small apartments, was described in considerable detail, chiefly by Miss Gleason herself, in CONCRETE for January, 1921.

Her work is of uncommon interest, not because it was done by a woman, but because being a woman she ditched a few man-made traditions. She did her own thinking, starting from fundamentals. The fundamental requirement of a house is that it provide an enclosure for and the equipment of a home.

She started with the functions of housekeeping as practiced in apartments, and sought to provide something better. The very small house is usually an atrocity, with bad proportions that scream at you in unmistakable terms of ugliness. In the matter of plans Miss Gleason's houses speak for themselves. Yet when it is realized that she thinks in units of 10 feet (for economical design), it is impossible to understand the effect of roominess in her houses without seeing them. The point of the whole matter is: when she laid out a small plan, she had the wisdom to consider height as an inseparable factor. Instead of traditional 9 ft. ceilings (necessitated, she says, by low hanging gas chandeliers which have gone out of use), her story heights are 7 ft. 6 in. Her trim—her windows—everything is proportionate to plan size. Of equal importance with her sense of proportion in solving her small house problem, is her appreciation of the strength of her materials—so that she uses a minimum.

Her factors of safety are not as high as most building codes require. If her workmen in every case have



FIGS. 3-6—INTERIORS OF THE GLEASON HOUSES—THE KITCHEN IS FURNISHED COMPLETE, AS SHOWN

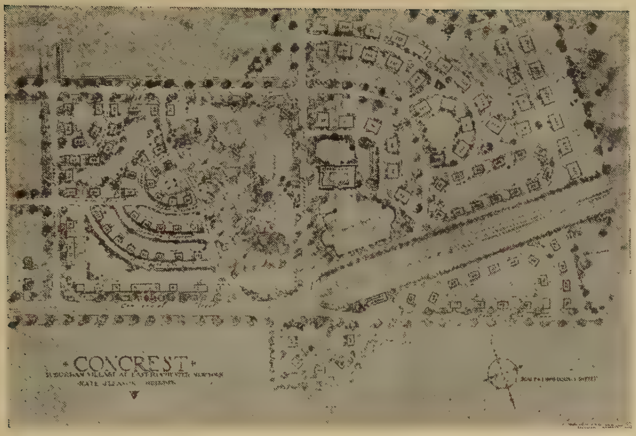


FIG. 7—THE LAYOUT OF "CONCREST," THE GLEASON DEVELOPMENT AT EAST ROCHESTER

been conscientious about the quality of her concrete, our makers of building laws may learn something from her about economy. A man may build frail frame houses, but if he wants one of concrete he must usually waste half the material he uses in providing unecessary and undesirable thickness and weight.

After Miss Gleason climbed the hill with the 20 x 20 ft. three-story houses (basement at grade on the lower street and first floor at grade on the upper street), she designed 20 x 30 ft. plans for ordinary grades. Three of the new plans are shown. "Most people are astonished," says Miss Gleason, "that I can build such a house as cheaply as the 20 x 20, but the figures tell the story. The 20 x 20 had a 12 in. foundation, an 8 in. garage (basement) story wall, a 6 in. living story wall and a 4 in. second story or bedroom floor wall; 80 cu. yds. in all. The 20 x 30 has a 7 in. foundation, with 20 in. base, a 6 in. living and garage wall, and a 4 in. bedroom wall; 65 cu. yds. in all. Then there is only one stairway. And there are 600 sq. ft. of reinforced floor, instead of 800 sq. ft. The only thing that costs more is the roof, and that is just the extra material. There is practically no more time on the 20 x 30 than 20 x 20 roof. Most of the labor goes into making the corners, and there are just as many corners on a 20 x 20 as a 20 x 30.

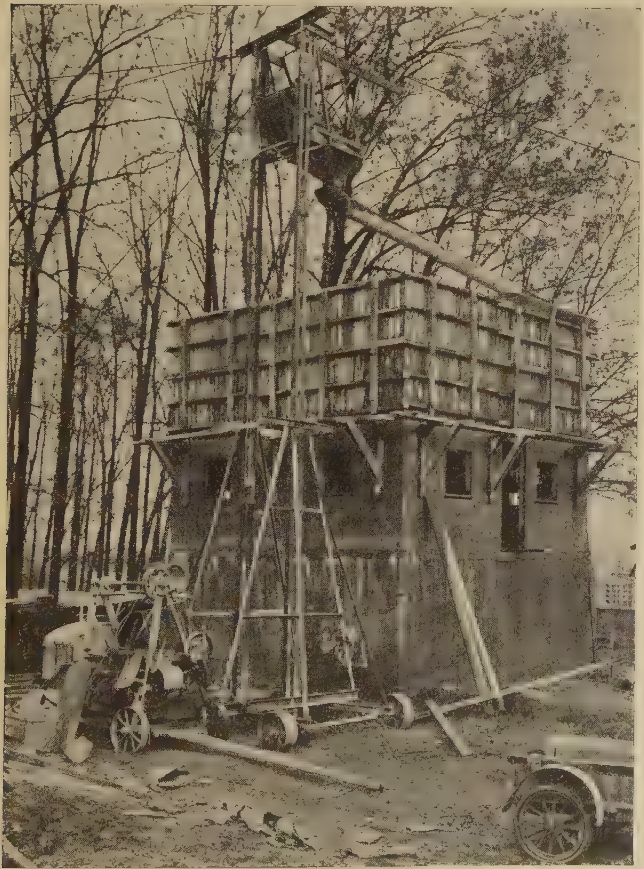


FIG. 8—FORMS, MIXER AND SPECIAL TELESCOPING TOWER ON WHEELS FOR PLACING CONCRETE

"We built a couple of hip roofs, which are popularly supposed to be cheap and I found the labor cost just double the straight roof with gables—so much time lost in fitting angles."

For those who did not read the article published in this magazine a year ago, the following regarding the Gleason construction is quoted from the previous article and the accompanying illustration showing a house under construction is also republished:

> The houses are being built a story at a pouring, with wood forms made up in panels of ⅞ in. matched lumber, on 2 x 4's, about 3 ft. 6 in. by 10 ft.—of such a size that four panels make one side wall, requiring 32 panels to a story height. Four by four liners and bolts through the wall, with spacers, keep them in place. The bolt holes provide a hold for scaffold brackets.
>
> Gravel concrete is used from a Jaeger mixer, discharging into the skip of a special angle-iron framed, telescoping tower which Miss Gleason designed to meet a need for light-weight, easily and quickly moved, placing equipment. The tower is mounted on wide tired wheels, and the skip discharges to hopper and chute.

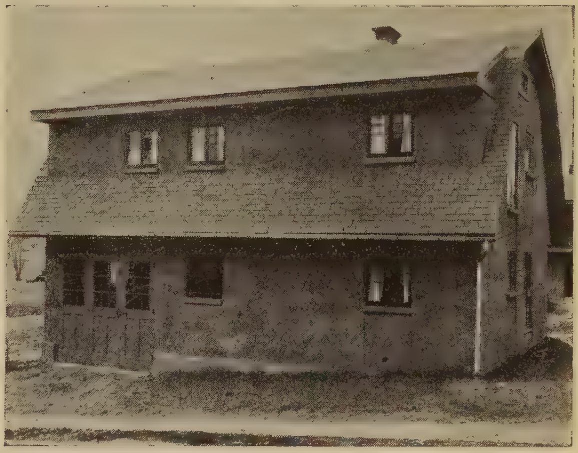


FIG. 9—REAR VIEW OF THE NEWER 20 x 30 HOUSE, SHOWING GARAGE ENTRANCE

"The biggest hurdle I had to make was the plastering. It is affected by so many things that one can't control; the weather, the material and the mason. The finished concrete floor has been another uncertainty and the putty in the windows has been a good third.

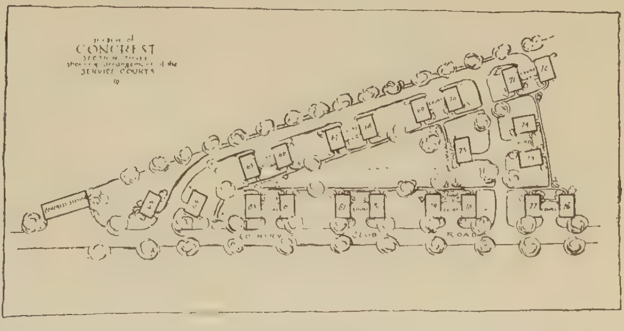


FIG. 10—A SECTION OF GLEASON DEVELOPMENT, SHOWING ARRANGEMENT OF SERVICE COURTS

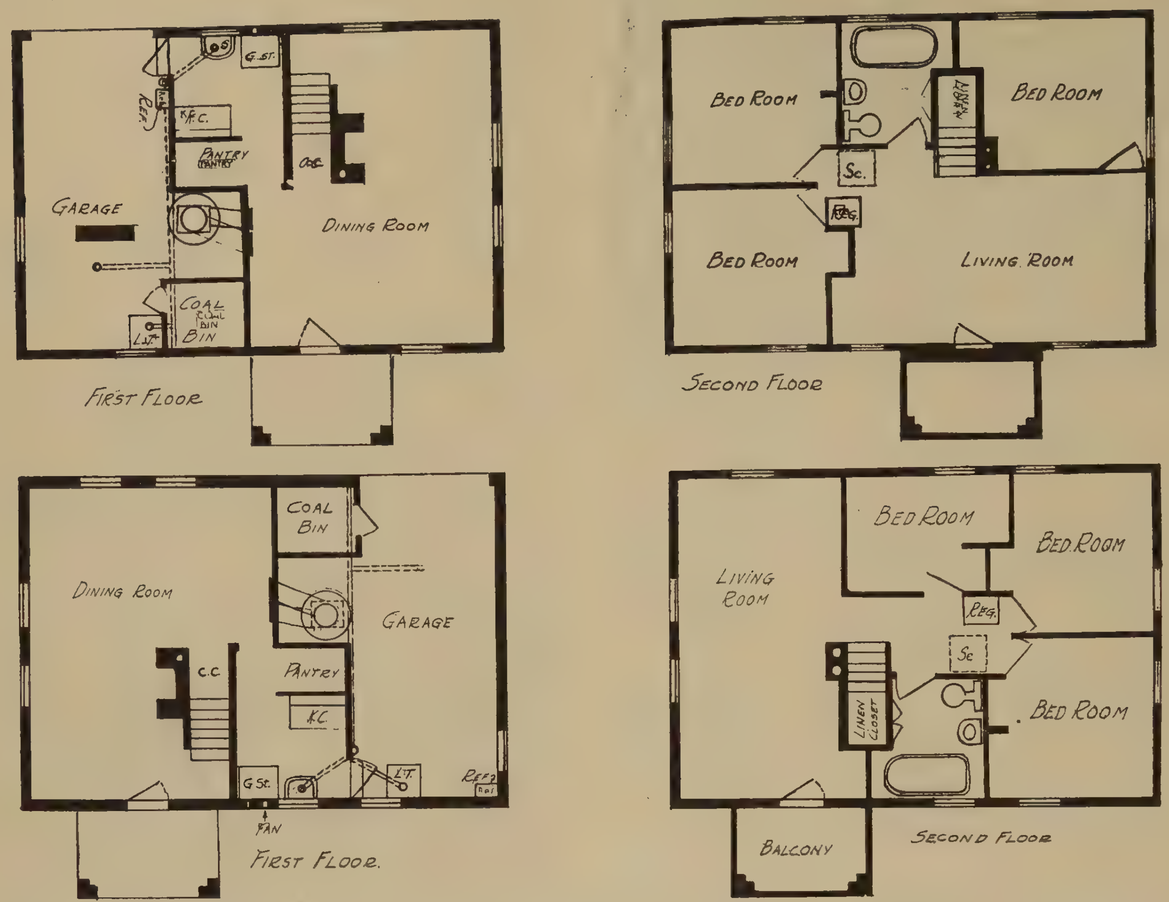


Fig. 11—Plans Are Varied Within Identical Outside Dimensions—The Newer 20 x 30 Houses Have a Living-Room on the Second Floor

"It seems to me the way to get around such things is to adopt for house-building the methods that have been so successful in automobile building; assemble well made parts that show their quality on first inspection.

"The most important change we have made to avoid plaster ceilings on the first floor is to use an open reinforcement and pour through it to iron plates for floor forms. I like the Clinton electric welded wire because we can get it in strips 86 in. wide, cut 24 ft. long, which takes care of the Dutch roof overhang as well as the floor.

"For the second floor ceiling, we are still using up our stock of plaster boards, but we have some check cracks, and I hope to have something better to report next year.

"We get away from plaster on the sidewalls by substituting water-proof fibre board for the plasterboard and over this framing canvas, seamed and stretched to cover the whole wall, so we don't have to mar it with strips. This sounds expensive, particularly when I tell prospective customers that the canvas is put on by the Tiffany method. But the fibre board when bought direct from the mill is less than 1c a sq. ft. and the 8-oz. duck 36 in. wide is about 2c a sq. ft.—both together cost less than the plasterboard alone. The canvas makes a beautiful finish without painting so we save the cost of the material in plaster and paint. The fibre board goes on much quicker than the plaster board and putting on the canvas, as we do it now, takes less time than plastering, but for the first few houses it took four or five times as long. One great advantage of this wall finish is that it gives us double air spaces. We are using plasterboard in the walls of the kitchen and bathroom until our present stock is used up.

"I thought last year I was sure of our finish on cement floors. But I found that all I was sure of was the finisher I then had. When I had to promote him as the organization grew the floors got very uncertain, two of them so bad we had to do them over, so now I let the finished floor come as it will and what I save in labor, paint or wax, I put into wood carpet or lineoleum.

"The way I manage the putty difficulty is to use white lead instead and squeeze into it a tiny quarter-round nailed tight against the pane. It is more expensive for the first operation, though we are fast getting the time down. It is not so expensive as puttying and painting windows twice a year.

"One great advantage we have in setting forms and pouring the 2-story house is the number of operations we have been able to cut out." Miss Gleason tabulates these operations as follows:

3-Story	2-Story
Form for foundation	Form for foundation & stair wall
Pour	Pour
Strip	Strip
Form for 8" wall	
Pour	
Strip	
Form for 1st floor, beam and column	
Pour	
Strip	
Form for cellar stairs	
Pour	
Strip	
Form for chimney to 1st floor	Form for 6" wall, stairs, stair well, 2nd. floor, beam, 2 columns, chimney to roof, 4" wall, 2' roof overhang and porch—one operation
Pour	
Strip	
Form for 6" wall	
Pour	

Strip
Form for 2nd. floor, beam and column
Pour
Strip
Form for upper stairs
Pour
Strip
Fireplace
Form for 4" wall
Pour
Strip
Form for chimney through roof
Pour
Strip
Form for porch
Pour
Strip
Carpenter work on 2 ft. overhang on roof
Cement-plaster work on 2 ft. overhang on roof
Three-story house, 37 operations.
Two-story house, 7 operations

Pour-one operation
Strip-one operation
Fireplace

"I am tempted to publish our time or contract price. But I know from experience that may be unfair to someone starting out, who might give up too soon if he had a chance to compare time records. We had no one's records to help or discourage us and I'm glad we hadn't." [The houses are selling for $4,000 and $4,500, the extra $500 for especially desirable lots, and Miss Gleason says she is making a profit.—Editor.]

"I am more than ever in favor of building the garage in the house." A plat plan shows how the garage entrances and the service courts are worked out to give a good appearance.

"We are using the same mixers, cement lifters, Fords and trailers we had last year. Our trucks gave out and it is my opinion that the rough ground around a building job is too hard on trucks. It is better to use a Ford auto chassis with one-ton trailers for supply and salvage work, and teams for grading. We have not made the promised improvement in scaffolds yet. Perhaps next year, when finances are easier, we will do better.

"Since the 10th of November we have furnished hot coffee at noon and a warm place to drink it. There is no doubt it keeps up production in damp chilly weather."

Here are Miss Gleason's specifications for 2-story houses, 20 x 30:

Foundations extend 3 ft. 6 in. below grade. Base 20 in. wide. Wall 7 in. thick; Mixture 6:1 gravel and cement.

Garage and furnace room Floor—4 in. thick with clean out and trap for washing cars.

Beam, T, 8 in. x 4 in. x 12 in., with two ⅝ in. rods.

Two Columns 8 in. square with two ½ in. x 10 ft. rods.

Chimney 12 in. sq. to 2nd. floor, lined with 8 in. flue lining, 12 in. x 24 in—2nd. floor through roof lined with two 8 in. flues.

Stairs reinforced with Self Sentering 24-gauge and tied to beam with two ⅝ in. rods running full length of stairs.

Stair well poured in one piece with stairway.

Garage and furnace room wall 6 in. thick, reinforced with two ⅝ in. rods over door. Firewall between these rooms and house proper.

1st. floor—18 in. above garage floor, cinder base, covered with tarvia; mixture rough floor 5:1, 3" thick. Finish floor 4:1.

2nd. floor—9 ft. span, reinforced with Clinton welded wire, 24 ft. long guaranteed for load of 70 lbs. per ft. Openings cut through reinforcement for stairway and register. Mixture rough floor 5:1, 3 in. thick. Finish floor 4:1, 1½ in. thick.

Fireplace—28 in. deep x 30 in. wide inside measurements, built of fire brick set up with fire clay and coated with crucible lining; faced with tapestry brick. Mantel and chimney breast cement with inserts of Pewabic tile. Flue 8 in. diameter fitted with damper to keep in furnace heat when fireplace is not in use.

Kitchen and bath room walls and all upper floor cealings, Niagara plasterboard ⅜ in. thick over air space, ⅛ in. finish plaster coat over all.

1st. floor wall 6 in. thick concrete; nailing strips 16 in. centers for air space fitted on inside with waterproof Fibre Board guaranteed for 35 lbs. pressure per sq. inch. Another set nailing strips making second air space, fitted with 8 oz. duck in framed panels.

Second Floor Wall—4 in. thick concrete; nailing strips 16 in. centers for air space fitted on inside with waterproof Fibre Board. Another set nailing strips, making 2d air space, fitted with 8 oz. duck in framed panels.

Roof—Dutch Colonial with 18 in. overhang at top and 2 ft. overhang second floor, 1 in. overhang at eaves; 2 in. x 4 in. x 16 ft. rafters and joists 16 in. centers. Roofed with No. 2 common yellow pine matched. Covered with asphalt shingles guaranteed for 20 years. Galvanized conductor pipes, painted, leading into rain water cistern.

Windows—All casement—two 2 ft. 10 in. x 5 ft. 2 in. Fourteen 2 ft. 8 in. x 2 ft. 6 in.; swing outward and held by strong hook and eye; bolt inside against 1 in. square shoulder. All reinforced completely around with ⅜ in. bar and two ⅜ in. bars above.

Trim—Cypress.

Doors—Cypress. Outside doors reinforced.

Fittings—
- Furnace, pipeless with cast iron firepot and hood.
- Coal Bin.
- Dangler gas range, 4-hole with broiler and oven.
- Refrigerator, capacity 50 lbs.
- Sink, 18 in. x 24 in. porcelain with combination mixing faucet.
- Laundry tray, 24 in., with aluminum cover.
- 30-Gal. hot water boiler.
- Kitchen cabinet, white porcelain top 40 in. x 25 in.—fittings white and glass.
- Electric fan fitted for outdoor ventilation to kitchen.
- Rubber mats or lineoleum for kitchen floor.
- Screens throughout.
- Shades.
- Fitted book shelves.
- Fitted wood box on casters.
- Fitted rods for stair carpet.
- Clothes hamper, towel bars and soap dishes in bathroom and kitchen.
- Electric Fixtures: 3-light shower in dining room, Dome and base plug in living room; Ceiling light in bedrooms, hall, bathroom, porch and kitchen; Receptacle in kitchen wall; Switches for dome and porch light; Benjamin cluster in garage; Shades for all fixtures except garage. Electric door bell.

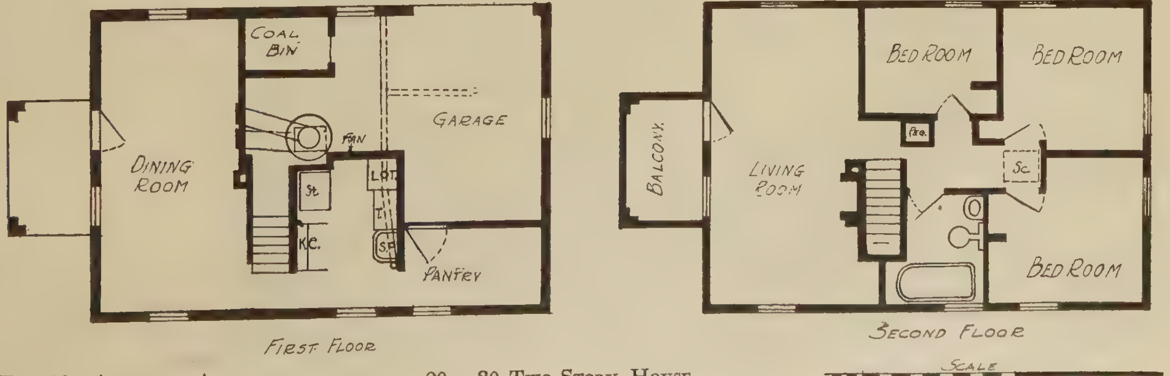


Fig. 12—Another Arrangement of the 20 x 30 Two-Story House

Painter System Employs Large Precast Units

The Painter system of house construction, devised by Walter S. Painter, architect, Reading, Pa., was inspired by the construction of 281 dwellings by the Unit Construction Co., at East Youngstown, for the Youngstown Sheet and Tube Co.[1]

On that job the houses were built of units as large as 12 ft. by 16 ft. cast in a large yard adjacent to the building site, and moved by industrial railways and supertrucks, and placed in the building by a specially built crane.

The system which Mr. Painter devised, the use of which he has demonstrated on a limited scale in the house which he is now occupying at Reading (see Fig. 1), was worked out to employ comparatively light weight units with inexpensive equipment, the outlay for which would be justified by a group of say twenty industrial houses in one building enterprise.

Molding, turning, stacking, conveying and setting the units—all of the operations are handled by a portable, traveling crane, see Fig. 2 (covered by U. S. patent No. 1,369,295). It may be designed for a cableway span of 300 ft. to carry loads up to two tons, but for ordinary housing purposes would have a span of 120 ft., as used by Mr. Painter at Reading, with a carrying capacity of one ton. Such a crane, covering an area of 14 ft. x 120 ft., and having a 30 ft. back leg, requires the following equipment and material:

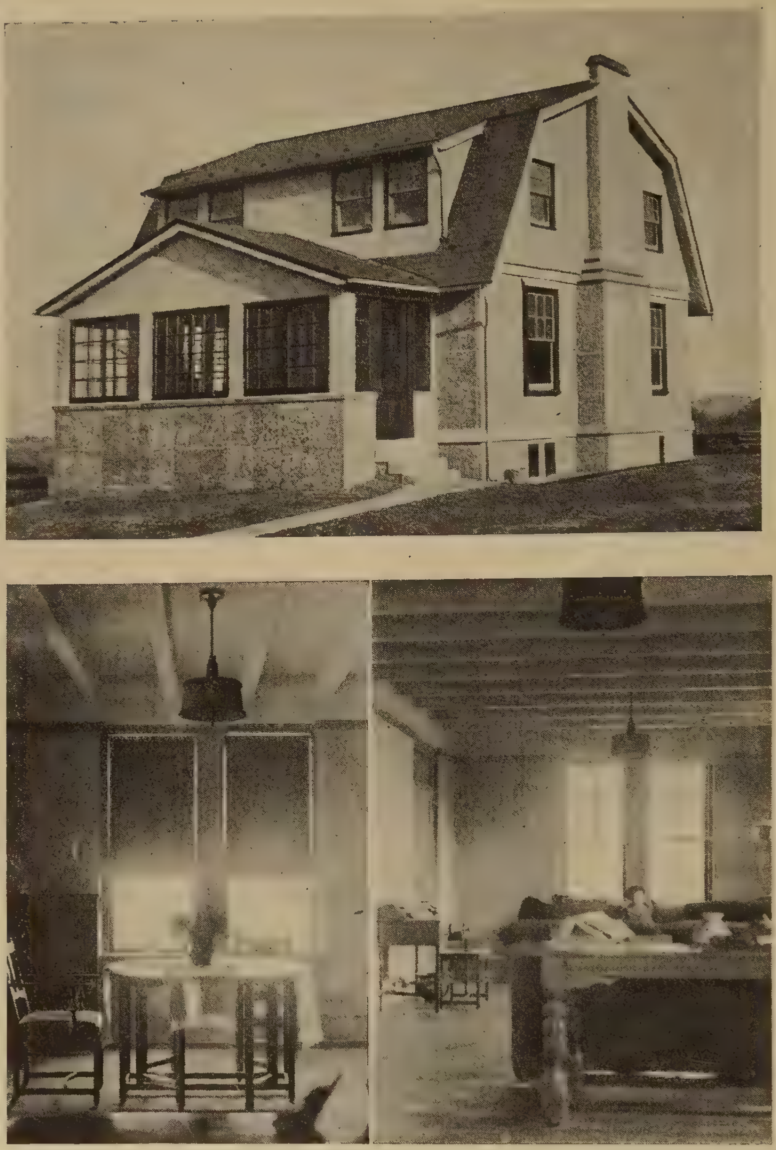


Fig. 1—Exterior and Interiors of Painter System House at Reading, Pa.

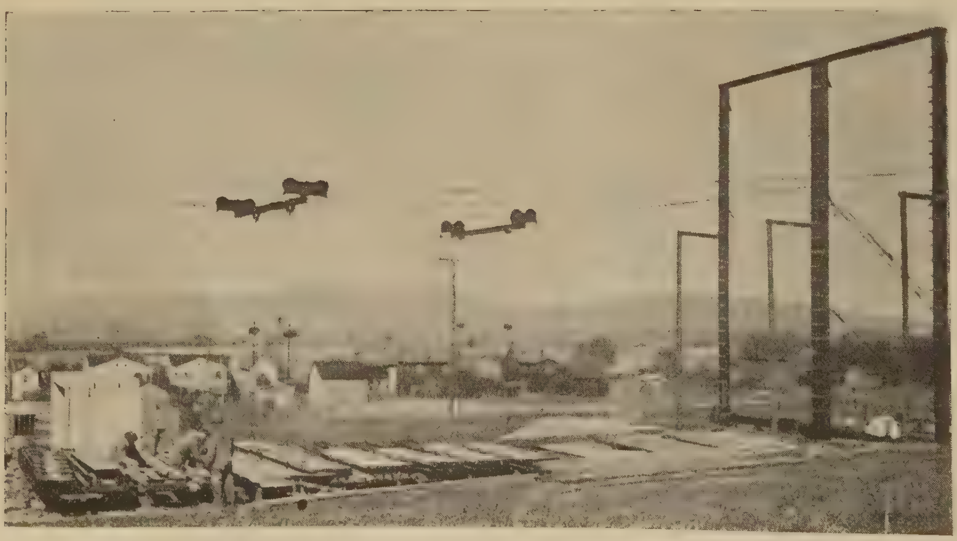


Fig. 2—The General Layout of the Job—Casting Slabs

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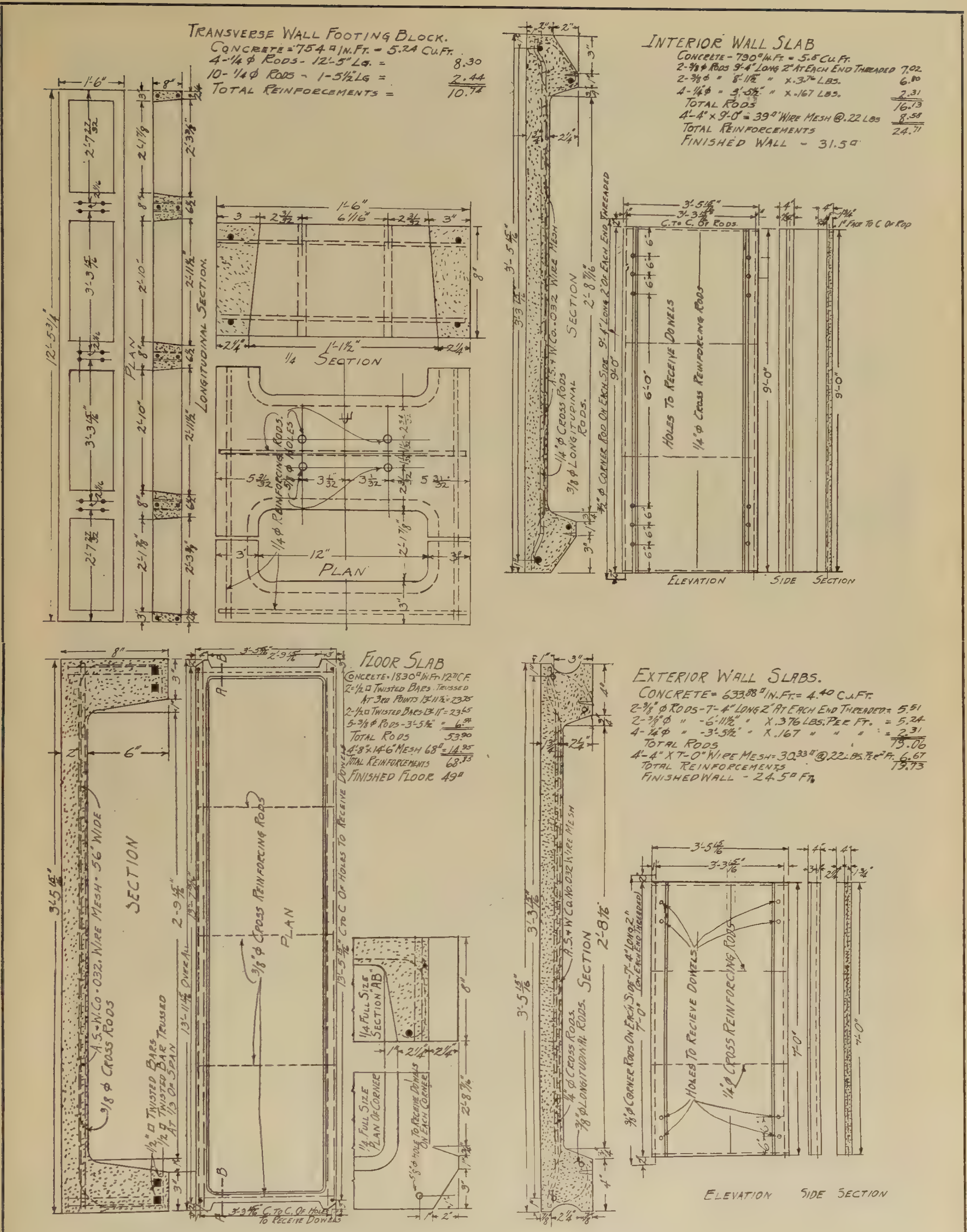
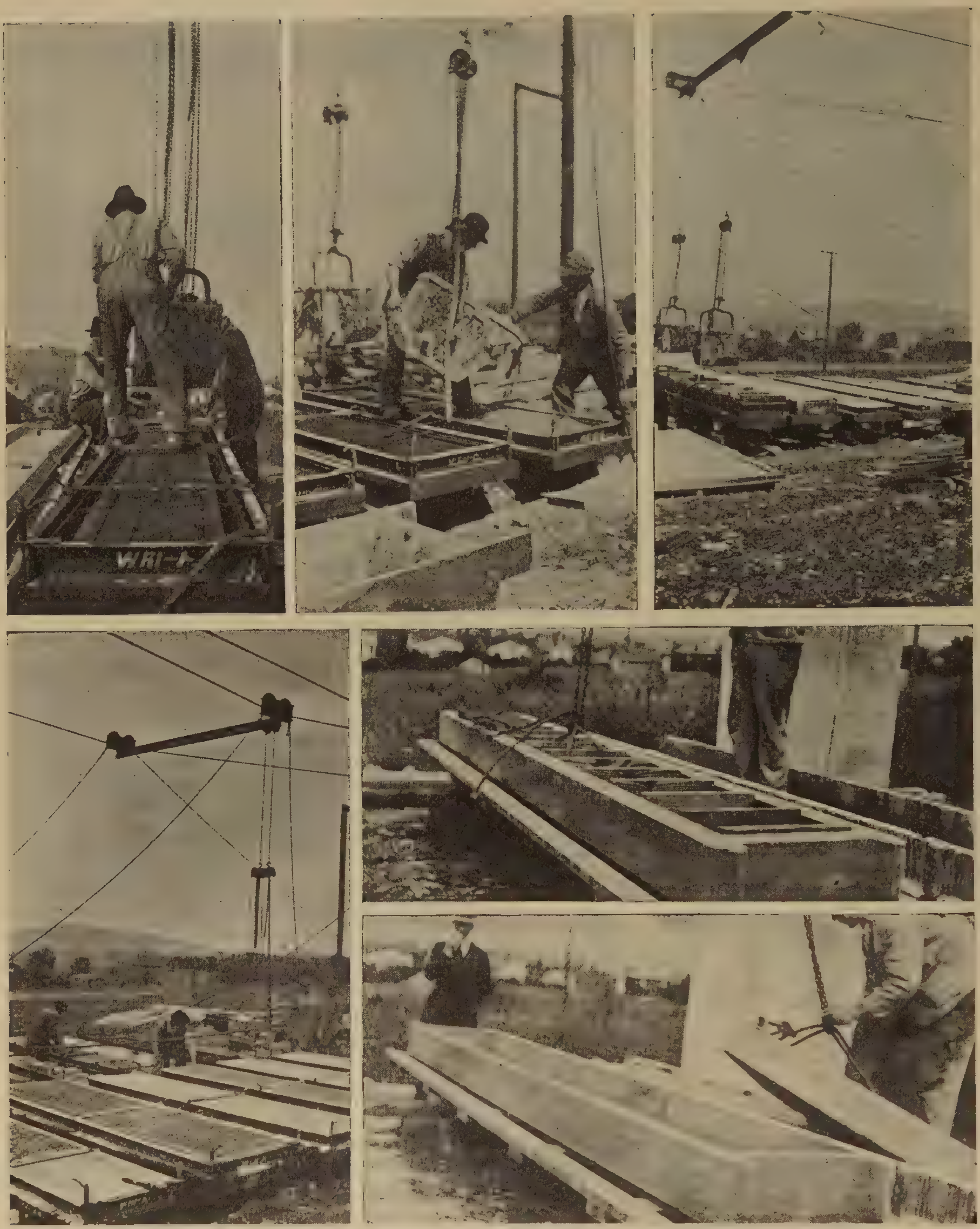
[1] See Concrete, January, 1918, and January, 1919.


TRANSVERSE WALL FOOTING BLOCK.
CONCRETE = 754 □ IN. FT. = 5.24 CU. FT.
4-1/4 φ RODS - 12'-5" LG. = 8.30
10-1/4 φ RODS - 1-5½" LG = 2.44
TOTAL REINFORCEMENTS = 10.74
PLAN
LONGITUDINAL SECTION
1/4 SECTION
PLAN
1/4 φ REINFORCING RODS
5/8 φ HOLES
INTERIOR WALL SLAB
CONCRETE - 790 □ IN. FT. = 5.5 CU. FT.
2-3/8 φ RODS 9'-4" LONG 2" AT EACH END THREADED 7.02
2-3/8 φ " 8'-11½" " X .376 LBS. 6.80
4-1/4 φ " 3'-5½" " X .167 LBS. 2.31
TOTAL RODS 16.13
4'-4" X 9'-0" = 39 □ WIRE MESH @ .22 LBS 8.58
TOTAL REINFORCEMENTS 24.71
FINISHED WALL - 31.5 □
A.S.+W.CO. .032 WIRE MESH
1/4 φ CROSS RODS
3/8 φ LONGITUDINAL RODS
3/8 φ CORNER ROD ON EACH SIDE 9'-4" LONG 2" OF EACH END THREADED
SECTION
C. TO C. OF RODS.
1" FACE TO C OF ROD
HOLES TO RECEIVE DOWELS
1/4 φ CROSS REINFORCING RODS
ELEVATION
SIDE SECTION
FLOOR SLAB
CONCRETE = 1830 □ IN. FT. = 12.71 C.F.
2-1/2 □ TWISTED BARS, TRUSSED AT 3RD POINTS 13'-11½" = 23.75
2-1/2 □ TWISTED BARS 13'-11" = 23.65
5-3/8 φ RODS - 3'-5½" = 6.50
TOTAL RODS 53.90
4'-8" X 14'-6" MESH 68 □ = 14.95
TOTAL REINFORCEMENTS 68.85
FINISHED FLOOR 49 □
A.S.+W.CO. .032 WIRE MESH 56" WIDE
3/8 φ CROSS RODS
1/2" □ TWISTED BARS
1/2 □ TWISTED BAR TRUSSED AT 1/3 OF SPAN
SECTION
3/8 φ CROSS REINFORCING RODS
PLAN
C TO C OF HOLES TO RECEIVE DOWELS
3'-3 7/16" C. TO C. OF HOLES TO RECEIVE DOWELS
1/4 FULL SIZE SECTION "AB"
1/4 FULL SIZE PLAN OF CORNER
5/8 φ HOLE TO RECEIVE DOWELS ON EACH CORNER
EXTERIOR WALL SLABS.
CONCRETE = 633.88 □ IN. FT. = 4.40 CU. FT.
2-3/8" φ RODS - 7'-4" LONG 2" AT EACH END THREADED = 5.51
2-3/8" φ " - 6'-11½" " X .376 LBS. PER FT. = 5.24
4-1/4" φ " - 3'-5½" " X .167 " " " = 2.31
TOTAL RODS 13.06
4'-4" X 7'-0" WIRE MESH = 30.33 □ @ .22 LBS. PER □ FT. 6.67
TOTAL REINFORCEMENTS 19.73
FINISHED WALL - 24.5 □ FT.
A.S.+W.CO. NO. .032 WIRE MESH
1/4 φ CROSS RODS
3/8 φ LONGITUDINAL RODS
SECTION
3/8 φ CORNER RODS ON EACH SIDE 7'-4" LONG 2" ON EACH END THREADED
HOLES TO RECIEVE DOWELS
1/4 φ CROSS REINFORCING RODS
ELEVATION
SIDE SECTION

FIGS. 3-6—DETAILS OF PAINTER SYSTEM—SEE TEXT

	First complete 14 ft. Bent	Each succeeding 14 ft. Bent
L. I. Y. P. 4S	2,124 B. F.	1,062 B. F.
Y. P. sills, rough	378 B. F.	252 B. F.
Ironwork, rods, pins, bolts, turnbuckles, and sheaves	1,250 lbs.	660 lbs.
1⅛ in. diameter cables— Two 220 ft. long	440 L. F.	440 L. F.
¾ in. diameter guys— Four 50 ft. long	400 L. F.	200 L. F.
Steel travelers	400 lbs.	400 lbs.
Trolleys, 1,000 lbs. capacity	2	2
Chain blocks	2	2
⅝ in. diameter manilla rope drag lines.	600 L. F.	600 L. F.
⅝ in. diameter blocks 6 in.	4	4
Geared 8 to 1 winches	2	2
Deadmen	4	4

The material for such an outfit will cost, according to Mr. Painter, approximately $700 for the first complete bent and about $450 for each succeeding bent.



Figs. 8-13—Casting, Finishing, and Turning Slab Units

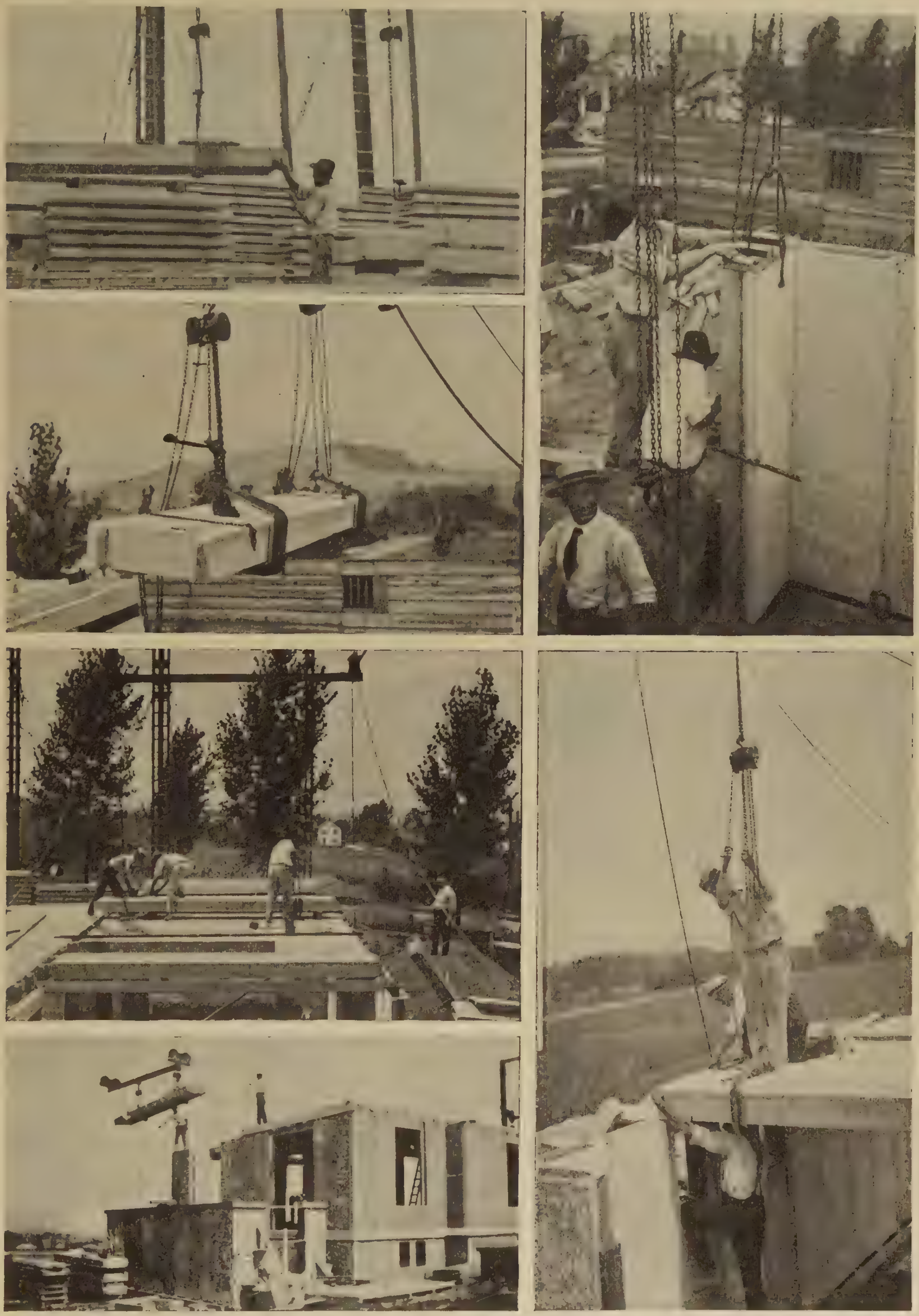
When the casts are all made and while they are curing, this same equipment is employed in handling the excavation and removal of earth.

The Units Employed

The units consist of a wall foundation block (U. S. patent No. 1,369,296); interior wall slabs (U. S. patent No. 1,369,294); floor slabs, exterior wall slabs, exterior corner wall slabs, and string course units.

The details of the wall foundation or footing blocks are shown in Fig. 3. This footing block is cored, is generally 18 in. wide and 14 ft. long, with a series of cross webs at such points as to come at the junction of each superimposed unit. This footing block is studded with holes to receive the dowel pins located in the superimposed wall units. After the footing blocks are set in place, lined and leveled, sufficient concrete is poured in the open spaces of the block to fix them securely.

The interior wall slab, shown in Fig. 4, is a trough or channel shaped section, the sides or flanges heavy enough to serve as supporting studs. The flanges are so chamfered that when placed against the exterior slab a hollow wall is formed, with a comparatively small contact between the exterior slab and the interior slab, thereby minimizing heat loss. These two concrete slabs are clamped together in the wall with metal ties fitting over



Figs. 14-19—Detailed Operations of Erecting House—See Text

the projecting rods, which serve also as dowels. The ties are grouted in place and, with the dowels, tie the slabs into the foundation course at the bottom and into the floor slabs at the top. The interior wall slabs are finished when fabricated with plastered surfaces.

The floor slabs (Fig. 5) are built to span from wall to wall, are pan shaped with side and end flanges and have holes to receive the projecting rods previously embedded in the wall units. The floor slabs come from the forms sufficiently smooth to finish without plaster, and the pan-shaped units placed side by side form a beamed ceiling.

The exterior wall slabs are similar to the interior wall slabs, except that the chamfer is omitted and a half ellipse placed in the side flanges in such a position that two adjoining slabs form a stud having an elliptically shaped hollow center, which is grouted to prevent the passage of air and moisture. This exterior slab is detailed in Fig. 6. The exterior wall slab is given a special surface, so that no special treatment is required after erection.

There is a special exterior corner unit, similar to the wall slab, except that it is of sufficiently greater width to cover the adjoining transverse wall, and is cast with a hollow corner space to permit grouting.

The string course is made to project over the wall courses with proper drips, and has projecting flanges fitting inside of the thin plate of the wall slabs, both above and below the horizontal joint. This string course is provided with holes to receive the rods projecting from the wall units below and the wall units for the story above. A window detail is shown in Fig. 7.

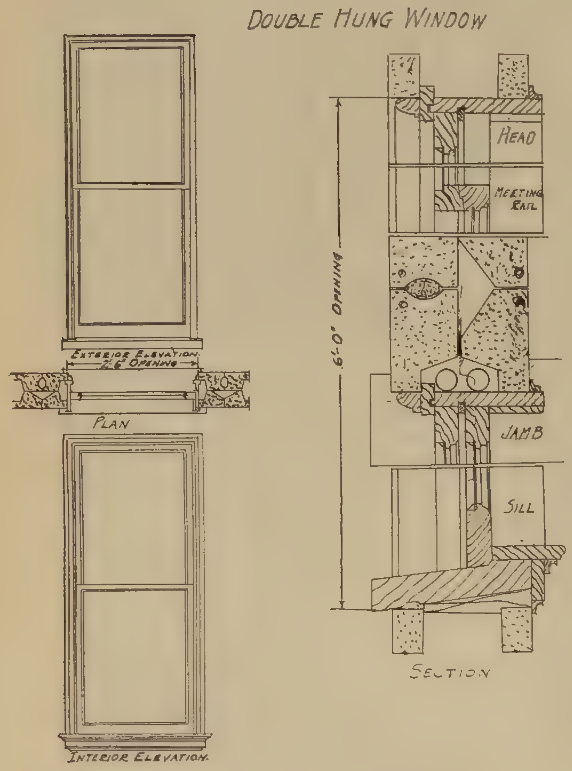


FIG. 7—WINDOW DETAIL, PAINTER SYSTEM

FORMS AND CASTING

Forms are made of steel and of wood. Equipment to cast units for 6-room-and-bath houses (according to a design worked out by Mr. Painter, the houses to be double, each 14 ft. 4 in. wide by 43 ft. 4 in. long, two stories high), containing 180 pieces, every nine working days would consist of 65 forms, the cost of which is estimated at $6,000.

A general view of operations is shown in Fig. 2, and various operations in casting in Figs. 8 to 13.

The forms are placed on timbers, two 2 x 6's, running parallel with the cableways and blocked level, a sufficient distance from the ground to permit bolts to be withdrawn and put in place. Reinforcing consists of rods and American Steel and Wire Co. triangular wire mesh.

Concrete, turned out by a portable mixer, is dumped in buckets which are picked up by the derrick and moved directly over the forms. Interior surfaces are struck smooth and trowelled. Exterior surfaces are pebble-dashed or otherwise surface finished. All units are so cast that the exposed surfaces are up and accessible. After the concrete has hardened for about three days, the forms are turned by a tackle from the crane, cores are removed, and the casting is picked up and placed in a stack. Forms are then cleaned with wire brushes, oiled with paraffine oil, reassembled and the operation repeated. Four men are used in the casting operation, and Mr. Painter reports that four men turn out two and one-half casts per hour, this including cleaning, oiling, turning, and placing steel. Concreting and finishing required another four hours. This gives ten casts in four hours, or a cost of $1.28 per cast with labor at 40c per hour. The largest unit is the floor slab, and contains but 12.71 cu. ft. of concrete.

ERECTION

Mr. Painter also reports that four men can readily place the foundation blocks for two houses in one day. Wall slabs are then erected on one longitudinal wall complete. This is lined and stayed with A frames, wedges and braces.

The opposite wall sections are then put up and the floor slabs placed in position as soon as three wall slabs are in place. In placing wall units, the projecting rods, which are threaded, permit the use of a sling board being placed on top of the slab so that it may be lifted in a vertical position.

The floor slabs are picked up and brought to the floor level where they are turned, having been stacked upside-down for the removal of cores.

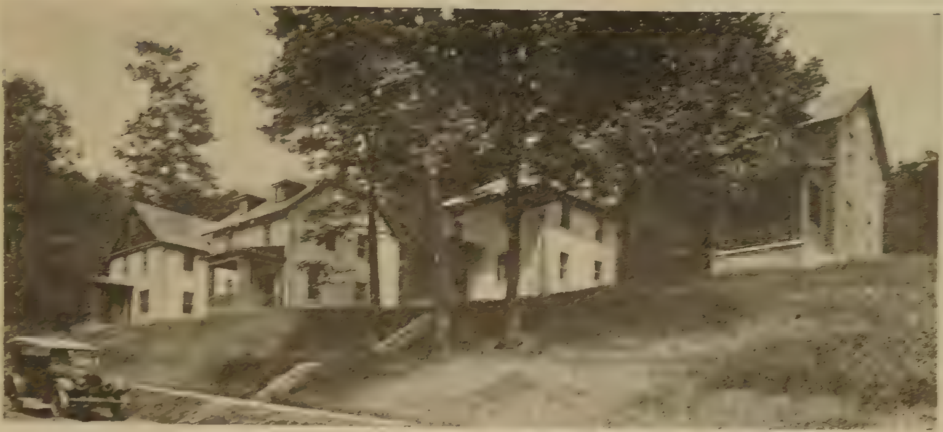
Before placing slabs the receiving surfaces are covered with mortar so as to insure uniform bearing. Mr. Painter claims that four men erecting have placed 20 pieces in three hours, or at the rate of 24 cents per slab, erection cost. This rate, he does not believe could be maintained ordinarily, and estimates the usual cost at 50c per slab.

To make the best and most economical use of his system, Mr. Painter has designed houses to employ a 14 ft. length of floor unit; the house in double row type construction to be 14 ft. center to center of dividing walls, or party line, it being pointed out that very few industrial houses have any one room the smallest dimension of which is larger than 13 ft. 4 in.

Progress views in the erection of a house by this system are shown in Figs. 14 to 19.

The American Concrete Institute, at its 18th annual convention to be held in Cleveland, February 13, 14, 15 and 16, will have a Session on *Houses*. Miss Kate Gleason will tell how she is building 100 Concrete Houses.

Fig. 1—Three Concrete Homes and One Brick House Entirely Finished and Occupied for Some Time



Cambria Steel Company Completes 89 Hollow Wall Houses

By E. T. Gray
Chief Civil Engineer, Cambria Steel Co.

The Cambria Steel Co. is, at the present time, engaged in completing an addition to Johnstown, Pa., consisting of one hundred houses with a number of new streets and alleys. This development is located in the Cheney Run water shed back of the Memorial Hospital, contiguous to the Eighth Ward of the city of Johnstown.

Streets have been cut along the hillside following easy grades so that all parts of the layout can be reached without any heavy hauling. The lines of the Johnstown Water Co. and Consumers Gas Co. have been extended to completely cover the layout and a double system of sewers has been installed. This is the first section of Johnstown or vicinity in which the storm sewers have been completely separated from the sanitary sewer system and all the older parts of the town will require a change in the house connections upon completion of the sanitary sewer system.

The dwelling houses, some of which have already been described in Concrete[1] are being constructed of concrete by the Van Guilder double wall system. In this type of construction the concrete is placed by means of a patented machine which enables two walls to be built at once with an air space between. These walls are tied together by cross reinforcing and each wall is thoroughly reinforced longitudinally, making a stronger structure than a brick wall of equal thickness.

The openings between the walls, or air space, is two and one-half inches wide and extends from the bottom of the cellar to the roof. This gives a stratum of dead air, which is the best insulator known, between the inside and outside of the building. This is the effect that has been sought for in the older types of construction by means of furring strips between the wall and the plaster. The ordinary furring strips, lath and plaster, however, are usually broken at the floors, with the result that the insulation is incomplete.

Experience with houses built by the Van Guilder method in Minnesota and Manitoba indicates that there is a saving in fuel of about 35% in these houses over houses of the same size built by the ordinary methods of construction. The Cambria Steel Co. is, however, putting in heaters which would be adequate for any style of construction. The latest improved types of Williamson and Estate hot air heaters with pipes to every room, are being installed.

The cellars are high and roomy with concrete floor throughout and are completely equipped, in addition to the furnaces, with hot water tanks, water heaters coupled up with the gas service and standard laundry trays. The coal bins are equipped with an outside chute so that coal may be dumped directly from an upper street or alley through a steel chute into the bin. An additional special feature of the basement is the fruit cellar which occupies the space under the front porch and is completely insulated from the cellar as well as from the outside air by the Van Guilder double wall construction. This gives, on entering one of these cellars, the effect of a cold storage warehouse, for which, indeed, the Van Guilder walls have been used very successfully. To make this insulation more complete the floor of the front porch has been built of concrete, which adds considerably to the ease of cleaning and does away with the rotting of porch floors and posts through exposure to the weather.

The houses are of several types, most of them containing six rooms and bath, though there are a few of only five rooms and bath. Most of the six room houses contain attic space which can be converted into either one or two additional rooms, should the purchaser so desire. The five room houses and a few of the six room houses have no attic room except that reached through a hatch, but sufficient space is floored, in these attics, to provide ample storage room.

The houses are finished throughout in yellow pine which is stained and varnished in attractive shades. The floors are the best quality of edge grained fir. Ample closet space is provided for each room and hall, and complete cupboards are built in each kitchen.

The better grades of houses are provided with mantles and brick fireplaces, arranged to burn either a gas log or coal or wood fire, as may be desired.

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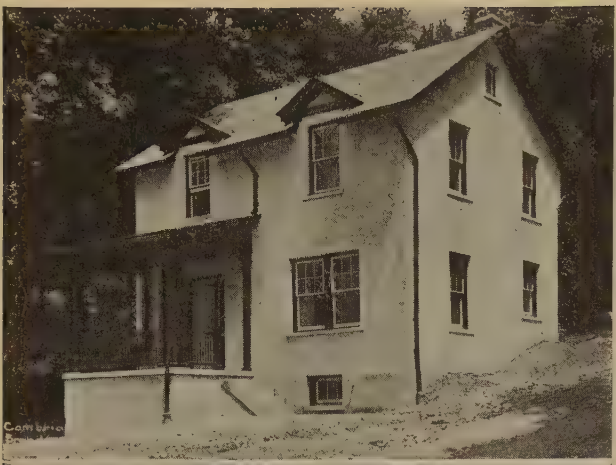
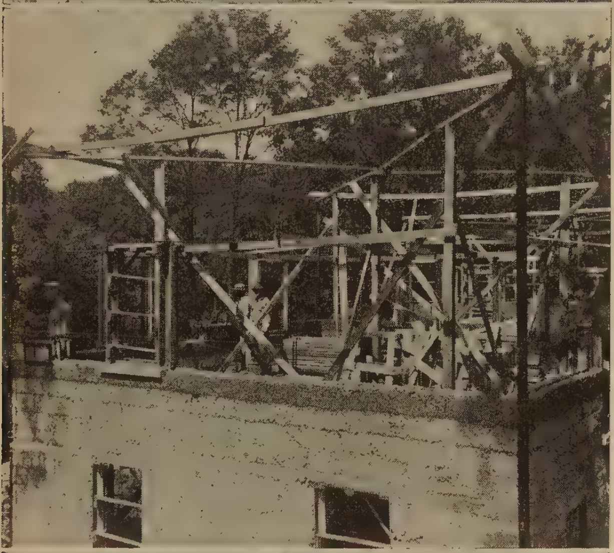
[1] Concrete, July, 1921.





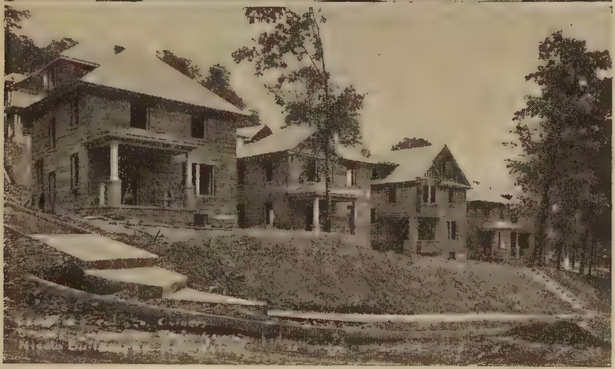


Fig. 2—One of the Most Popular Houses

Fig. 3—Typical Construction on Second Floor of a House Showing Two Van Guilder Machines in Operation, Precast Window Sill and Long Angle Irons Used at Corners

Fig. 4—A Number of Houses Finished on the Exterior Ready to Receive the Stucco

The houses are wired complete for electric lighting and fitted with neat electric fixtures. By special arrangement with the local firm who furnished these fixtures, any of the glassware which does not appeal to the house purchaser may be exchanged. Baseboard plugs in both first and second stories are installed so as to be convenient for electric irons, floor lamps, etc.

The exterior of the houses is being finished in various shades with Kellastone, a magnesite stucco, which is applied to the outside of the concrete wall and becomes an integral part of it.

The roofs are of very heavy slate and the buildings are as nearly fireproof from the outside as it is practicable to make dwellings.

As many as possible of the woodland trees have been left standing and the general appearance of the light colored stucco houses of various shades, as seen with the background and intervening patches of green, is extremely pleasing. The yards are neatly terraced and provided with all the necessary sidewalks and steps. Curbs and sidewalks are being laid on all streets and the streets themselves are to be hard surfaced with cinder, making a very hard and lasting surface for residence streets.

This project was started in October, 1920, in order to provide additional housing facilities for employees of the Cambria Steel Co.

Ten houses were started at that time and the construction carried through the winter so that these ten houses were not completed until May 1, 1921. Concrete walls for the remainder of the houses were started on Mar. 8, 1921, and completed for 79 houses on August 5, 1921. These 79 houses were practically finished December 15. Owing to the change in business conditions, the total of 89 houses are all of the originally contemplated 100 houses that will be built at the present time. We are unable at the present time to furnish cost figures, as the work is uncompleted.

The houses are being rented to Cambria Steel employees at a moderate rental, averaging only about 5½% on the estimated cost of houses and street construction.

Some of the interesting details of construction are shown in the accompanying figures. Fig. 3 shows typical construction on the second floor of a house with the two sizes of Van Guilder machines in operation, one a 5 ft. and the other a short machine for pilaster work. One of the important developments on this construction job was the use of long angle irons at the corners. These angle irons were made of sufficient length to reach the full height of the superstructure walls. They were put in place when casting of the concrete superstructure walls was begun, and securely braced through the building with the work space around the wall kept clear. The angle irons thus placed give the plumb lines and the outline of the building. The line stretched from iron to iron gives the straight line and plumb line to be followed by the machine.

The precast window sills were set in place after the

Fig. 5—View Showing a Number of Houses in Various Stages of Construction

Fig. 6—A Row of Completed Houses Showing the Variety of Appearances Attained

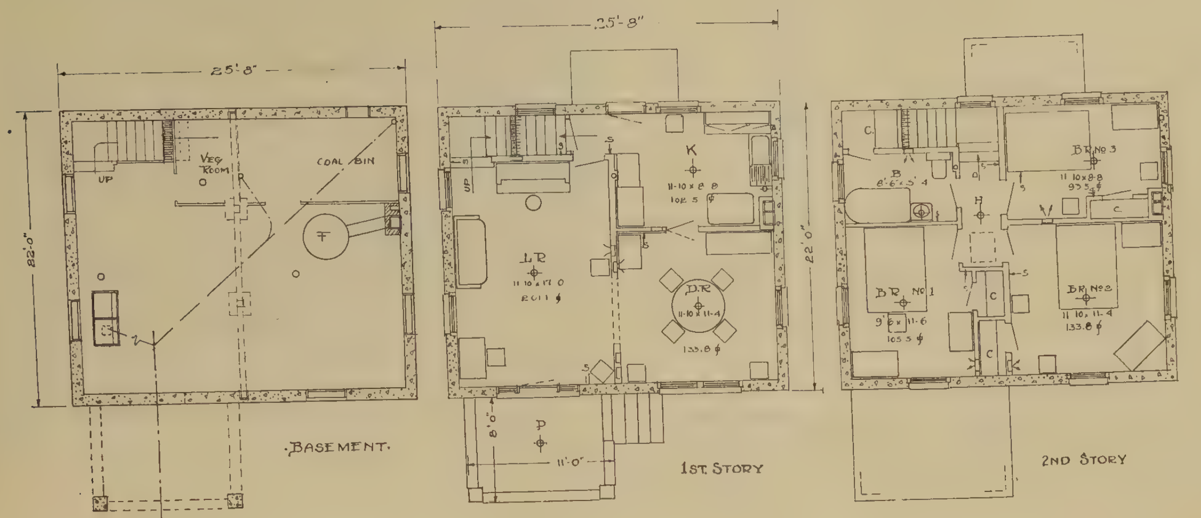


Fig. 7—Floor Plans for House Shown in Fig. 2

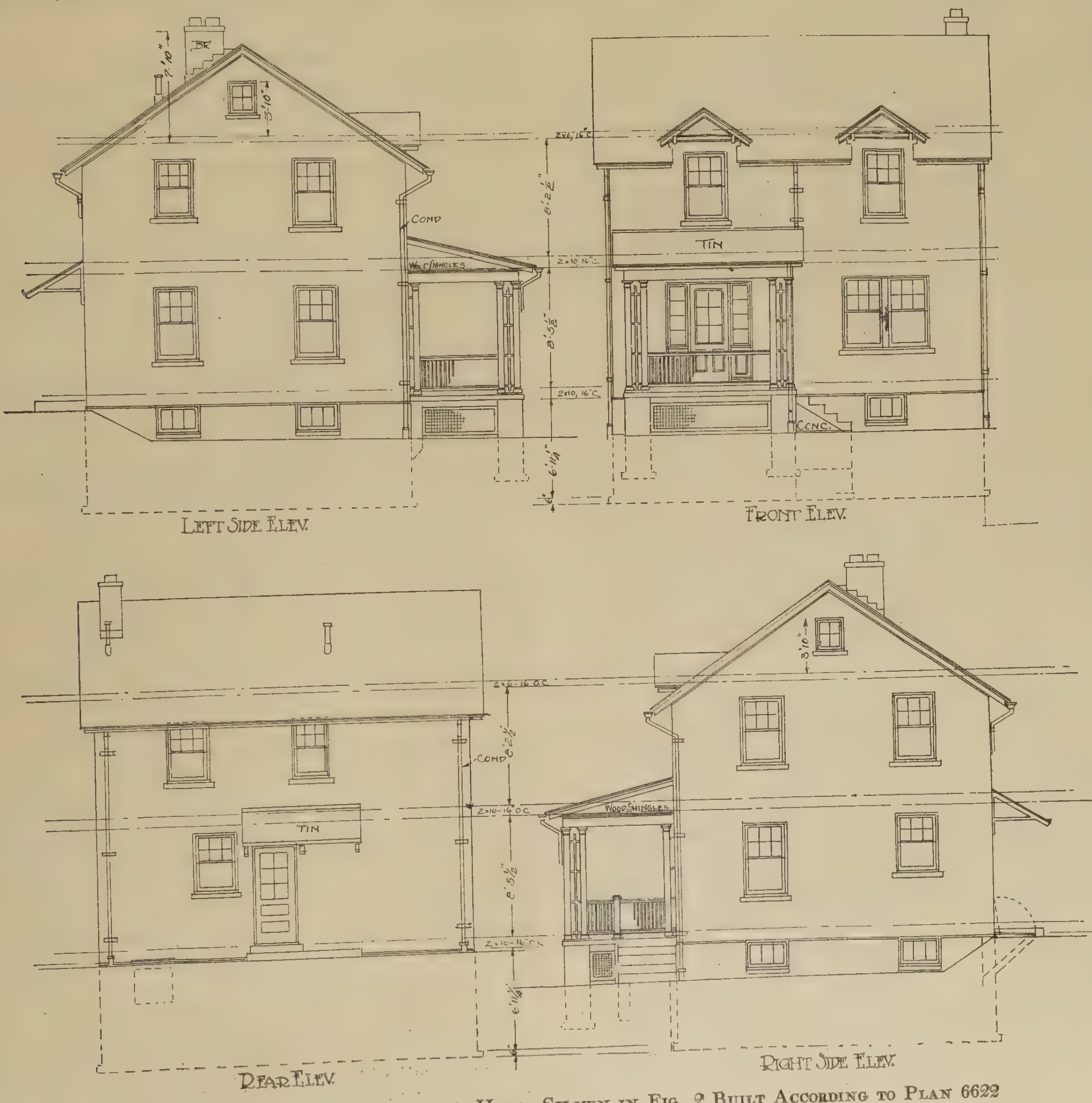


Fig. 8—Front, Side and Rear Elevations of House Shown in Fig. 2 Built According to Plan 6622

wall course had been properly leveled off and when placed in the building were finished, requiring no further treatment. This proved more satisfactory than stuccoed sills. Fig. 4 shows a number of houses finished on the exterior ready to receive the stucco. The stucco work is the last thing to be done on the exterior except wood porch railings and painting work. Experience has led the engineers to recommend that all grading and cleaning up shall be done around the building before the stucco work is started.

Fig. 5 shows a number of houses in Area "A" some of them entirely finished and others finished except the exterior stucco and porches. The finished houses present an unusually fine appearance in their hillside setting and the green foliage.

Fig. 2 shows one of the most popular houses, Plan No. 6622, the drawings for which are reproduced in Fig. 7 and Fig. 8. The house is entirely completed except the landscaping of the lot. Note the belt course on the right side of elevation has been elevated to suit the grade, and all stucco work to foundation levels including elevation of grade, has been taken care of with portland cement stucco.

The majority of the houses are entirely completed and the finished grading work done. The planting and seeding of the terraces will be taken up early next season and when entirely finished it is believed this group of houses will not only be one of the most attractive of its kind in the state, but will be an example of concrete construction that can be safely followed for future developments, as there is every reason to believe that the costs of this type of construction will be less in any locality, than other masonry construction.

Plans and specifications were made by the Brandt-Clepper Co., L. Brandt, housing engineer, and H. C. Clepper, architect, Pittsburgh, Pa. The contract for construction of the complete housing project including grading of streets was carried out by the Nicola Building Co., contractors, Pittsburgh, Pa.

Institute Program Appeals to Practical Men

The tentative program just announced for the eighteenth annual convention of the American Concrete Institute, at the Hotel Winton, Cleveland, February 13 to 16, has a good deal in it of interest to contractors and to engineers close to the practice of concreting. The subject matter leans to practice more than to theory. There are to be fewer formal papers and far more time for the discussion of every-day problems.

The convention will be spread over four days, instead of three, as in former years. Outstanding features of the program are: Two sessions to be devoted to discussion of the progress report of the Joint Committee on Concrete and Reinforced Concrete—chiefly those factors of the specifications which appear to contractors to impose on them some new and not altogether welcome responsibilities—see elsewhere in this issue a special article on the subject; two whole sessions for concrete products manufacturers; a session on contractor problems that will open with a demonstration of sieve analysis, consistency, slump tests, making test cylinders; a whole session on concrete houses; one on concrete roads and another on research, and another on concrete design. The tentative program is as follows:

Monday, Feb. 13—11 a. m.—Meeting of Committee on Committees (chairmen of all committees, to discuss future work of the Institute.

2 p. m.—*Concrete Roads*—Report of Committee S6 on Concrete Roads—presentation and discussion of revised standards. Clifford Older, chairman. Discussion of Plant and Material Handling Problems; moving pictures.

8 p. m.—*Concrete Houses*—Report of Committee S5 on Reinforced Concrete Houses (New Building Regulations)—E. G. Perrot, chairman. Papers and addresses by two or three builders of concrete houses—no theory, no guess-work, no *untried* conjectures—actual experience on *how* it is being done; one of these by Miss Kate Gleason, Rochester, N. Y., whose concrete houses are close to the hundred mark—*all sold—at a profit.*

Tuesday, Feb. 14—9 a. m.—*Research*—Report of Committee E3—Research, W. K. Hatt, chairman. A survey of important research which is being undertaken by various agencies and of research for which there is need; presentation of the Wason Medal, by Sanford E. Thompson, chairman Committee G5; announcement of the work of Committee G3 on Form of Standards, by the president; business session; report of Board of Direction, by the secretary; appointment of tellers to canvass ballots for officers.

2 p. m.—*Concrete Products Manufacture*—Report of Committee P1, on Standard Concrete Building Units (new standards for block, brick, and structural tile), R. F. Havlik, chairman; report of Committee P5, on Fire Resistance of Concrete Building Units, Lesley H. Allen, chairman; report of Committee P4, on Concrete Staves (special reference to strength and testing), Walter Brassert, chairman.

8 p. m.—Report of Committee J2, on Concrete Pipe—B. S. Pease, chairman—Institute representation; report of Committee P7, on Concrete Pipe, Drain Tile, and Conduit, C. F. Buente, chairman; report of Committee P6, on Products Plant Operation, S. H. Wightman, chairman, leading a general discussion of plant layout, equipment and operation problems.

Wednesday, Feb. 15—9 a. m.—*Field Problems*—A study of Proportioning Materials and Consistency, Slump Tests, Test Cylinders; a demonstration of sieve analyses of aggregates, water control, slump tests and casting test cylinders as a means of relating laboratory knowledge to field methods; report of Committee C1—Contractor's Plant, R. C. Wilson, chairman; report of Committee C2—Concrete Floor Finish, presenting simplified standard specifications, followed by two brief papers on Special Floor Finishing Methods.

11:45 a. m.—*Business Session*—Remarks by retiring president; announcement by tellers of new officers; induction of new officers.

2 p. m.—Report of Committee C3, on Concrete Surfaces, J. C. Pearson, chairman; Changes in Stucco Practice—Exterior of Industrial Buildings—Special Decorative Effects—Interior of Buildings—Bond of Applied Coatings; report of Committee C4, on Metal Forms, Edward A. Steele, chairman. Paper: Repair of Concrete Ships. Paper: Graphic Determination of Stresses, Prof. George E. Beggs.

8:30 p. m.—An informal social, get-together, with cider and doughnuts—here's your chance to buttonhole somebody and "tell him" or "ask him."

Thursday, Feb. 16—9 a. m.—Engineering Design and Inspection—Report of Joint Committee on Concrete and Reinforced Concrete, presented by reference to preprints previously distributed—S. C. Hollister, chairman—Institute representation. The report will be discussed by major subjects, led by chairmen of local committees of contractors from New York, Boston, Philadelphia, Chicago and elsewhere, and by chairmen of Institute standing committees, whose work involves a special consideration of subjects covered in various sections of the Joint Committee Report. The discussion will be centered chiefly upon the subjects in the following outline:

1. Quality of Concrete—Proportioning, Mixing, and Placing (Chapters III, V, and VI). Chairmen local contractor committees and N. M. Loney, chairman, Committee C6.
2. Details of Construction—Fireproofing and Construction Joints (Chapter VIII). C. R. Gow, chairman, Committee E4.
3. Waterproofing—Protective Treatments (special reference to Corrosion of Steel Reinforcement) (Chapter IX).

2 p. m.—Continuing discussion of Joint Committee Report:

4. Surface Finish (Chapter X). J. C. Pearson, chairman, Committee C3; N. M. Loney, chairman, Committee C2.
5. Design (Chapter XI), with particular reference to proposed Design Requirements on Cost of Construction; A. R. Lord, chairman, Committee E1, and chairmen local contractor committees.

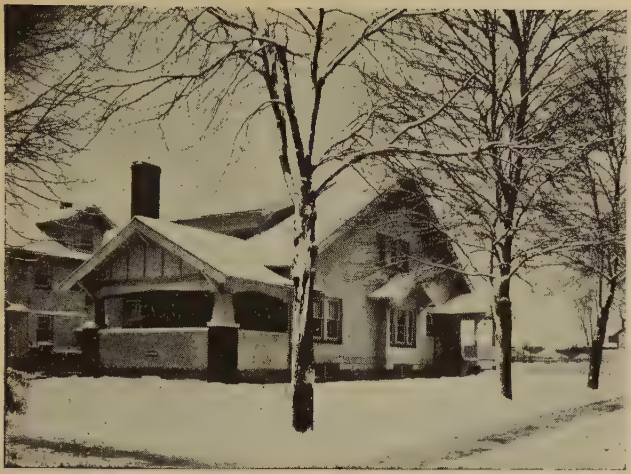


FIG. 1—HOME OF JOHN JOHNSON, NEWTON FALLS, OHIO—STUCCO ON CINDER BLOCK

Cinder Block—Yes or No?

BY W. D. M. ALLAN
PORTLAND CEMENT ASSOCIATION

> To the City Council Committee on Buildings and City Hall, City of Chicago—Honorable Joseph O. Kostner, Chairman:
>
> Gentlemen—Primarily with the view to stimulating the construction of small homes, the Joint Legislative Committee of the Illinois Chapter of the American Institute of Architects and of the Illinois Society of Architects, respectfully suggest to your Honorable Committee that there are a number of amendments that might be made to the existing building code of the City of Chicago that would result in cheapening the cost of buildings without in any way reducing the structural safety or sanitary requirements for buildings.
>
> We, therefore, suggest and recommend to your Honorable Committee . . . that the code be further amended so as to permit the use of building block made of cinders and portland cement.

The above resolution was presented to the Chicago Building Committee and appeared in the monthly bulletin of the Illinois Society of Architects for March, 1921, on page 3.

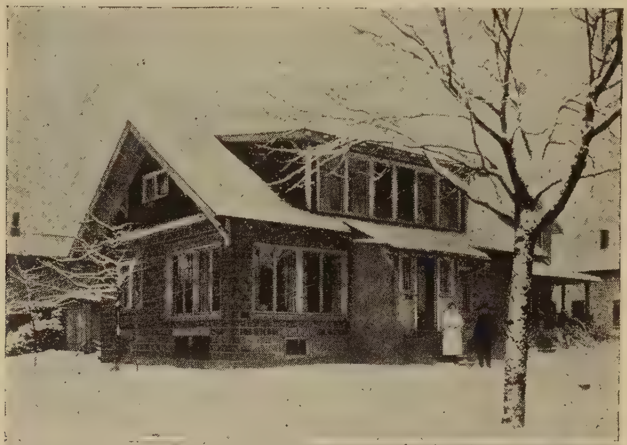
A few years ago it would have been difficult to find any recognized group of architects or engineers who would have given their stamp of approval to concrete block made of cinders and portland cement. Today, largely because of the experimental work of the past year, we find some of the foremost building code experts, engineers and architects, strongly recommending the use of cinder block for bearing and non-bearing wall construction, within proper limitations which are outlined later in this article.

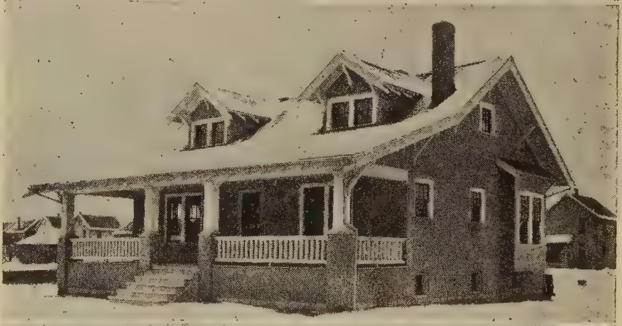
Before going further into the discussion of cinder block, it would probably be well to state just what the term means. For a number of years cinder concrete made of cinders and portland cement. Today, largely cement has been used in various types of construction. However, the difference between this kind of cinder concrete and the cinder concrete as we know it now is so great that in 1917 a patent was granted to F. J. Straub, of New Kensington, Pa., covering the use of precast building units made of crushed cinders and portland cement without the admixture of any other aggregate.

CINDER BLOCK ARE DURABLE

The first cinder block were made in New Kensington, Pa., nine years ago, and the buildings which were built from the block at that time are still in use and giving perfect satisfaction. The first building to be erected was a garage about 20 by 12 ft. and 9 ft. high, made of solid 4-in. cinder block. During the war this garage was plastered on the inside and used as a workman's home. There are now 1,500 buildings constructed of cinder block in New Kensington and vicinity, and all are giving satisfaction. There were more cinder block used in 1921 than in any three previous years. Cinder block have three striking advantages over other permanent building materials, namely: better insulation, better fire-resistance, greater economy.

In order to understand the cinder block, one must first establish clearly in mind the characteristic difference between cinder block and ordinary concrete block. With ordinary block, aggregates are carefully graded and proportioned to produce density. With cinder block density is not desired. Crushed cinders are naturally very por-





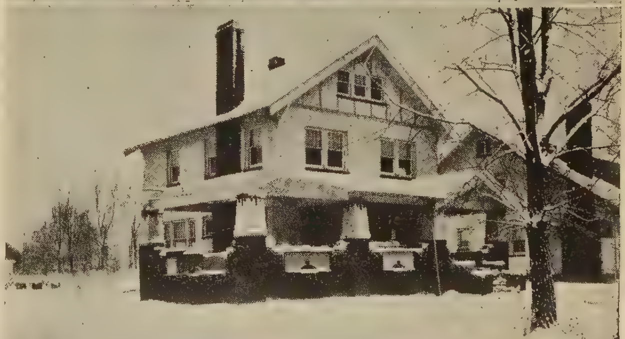


FIG. 2—CINDER BLOCK LAID UP WITH WHITE MORTAR—RED BRICK TRIM—HOME OF H. M. COLLIER, WARREN, OHIO

FIG. 3—HOME OF WILLIAM THOMSON, WARREN, OHIO—STUCCO ON CINDER BLOCK

FIG. 4—HOME OF JAMES FOULK, NEWTON FALLS, OHIO—CINDER BLOCK AND STUCCO

ous, and the more porous they are the more satisfactorily they can be used in residence construction.

Cinder Block Are Weather-Proof

The question is frequently raised regarding the waterproof qualities of cinder block. A good quality of cinder block will show an absorption around 16% to 18%. However, if this same block is laid in a foundation or in a wall without any outside protective covering, the inside wall will be dry. This is explained by the fact that the voids in cinder block are so large that moisture is not conducted through the block by capillary action. A parallel illustration may be helpful. If two glass tubes, one with a 1/128 of an inch bore, and the other with a ¼-in. bore, are placed upright in a pan of water, the water will rise much higher in the tube with the smaller bore, because the smaller the hole the stronger the capillary action. Whether or not this is the exact explanation of the action of cinder block is difficult to say. However, the fact remains that the cinder block under consideration are weather-proof in every sense of the term.

The majority of residences, store buildings and garages that have been built of cinder block have been plastered directly on the block. In fully half the cases the walls were not protected on the outside with plaster or brick facing, but were left exposed. Fortunately, two of the most important investigations that have been made on cinder block buildings in Western Pennsylvania were made during rainy seasons, when there was every chance for the plaster on the inside to show dampness if the dampness would come through at all. Out of 35 foundations below grade line which were inspected, only one was damp, and this was due to a broken water main.

The following letter from G. D. Jay, Jr., assistant to the President of the Citizens' Home Co., Studebaker Administration Building, South Bend, Ind., shows what this company thinks of cinder block:

Dear Sir:

The report which follows is a statement of condition of garage and house which we built of cinder block.

The garage was built of 4 by 8 by 16 cinder back-up block; it was not plastered on the inside nor stuccoed on the outside. The blocks were set to form a solid 4-in. wall, and there is no air space.

This garage is the best looking garage in the north end of the city. The gray cinder blocks, set up in red mortar, make a very pleasing appearance.

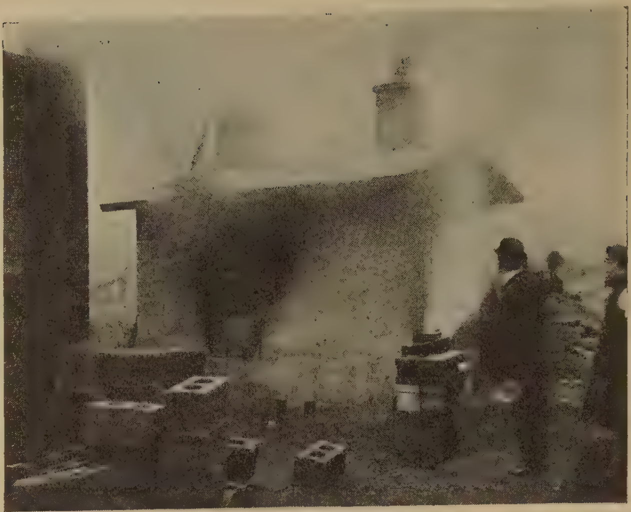
We have watched it very closely during the fall and winter storms, and not once has there been the slightest sign of moisture on the inside walls.

We are now convinced that 4 by 8 by 16 cinder back-up blocks will make a wall for garage and similar construction that will stand for all time and withstand the elements.

We built a six-room house on our Studebaker Place Addition with our McIntyre patented 12 tile 5 by 8 by 12, made with cinder back-up block, laid to form a 12-in. wall in the basement and 8-in. wall in first and second floors. This house has been plastered on the inside with magnesite interior plaster. It has not been stuccoed on the outside, as we found that the wall as laid out of cinder blocks presented a very satisfactory and pleasing appearance. We also wished to put cinder blocks to the severest practical test possible.

This house has been completed since December 1. A fire was maintained in the house for two weeks in order to set the plaster properly. Since that time no fire was maintained in the house until January 24, at which time the carpenters who were installing the interior trim started a light fire, which was maintained for two weeks. The plaster dried and set in the most satisfactory manner.

The house has been subjected to careful inspection at least once a week for the past two and one-half months. We have not, at any time, noticed any moisture on the inside walls. Plaster does not show any signs of any condensation of moisture. These walls were not furred on the inside; they were, however, treated with one coat of our Toch R. I. W. No. 232.



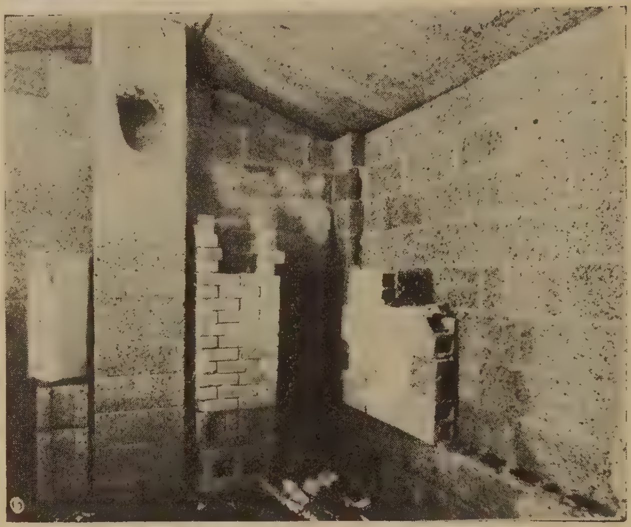


Fig. 5—Warren, Ohio, Fire Test of Cinder Block Structure, Nov. 16, 1921

Fig. 6—Interior of Cinder Block Building After Test

Fig. 7—Lower Portion of Wall Removed After Test—Note How It Is Self-Supporting

We believe that this house could be left without stucco on the outside, and that it would be warm and dry under any weather conditions.

Very truly yours,
The Citizens Homes Company.
(Signed) G. D. Jay, Jr.,
Assistant to the President.

Fire Tests on Cinder Block

Probably no subject has been discussed among concrete products manufacturers during the past year with more interest than the question of the fire resistive qualities of concrete block. In connection with National Fire Prevention Week in October of 1921, concrete block manufacturers in several cities built small concrete block houses and put fires in them to demonstrate the fire-resistive properties of various kinds of block. In every case the results were very satisfactory. Mr. Straub conducted fire tests at Lancaster, Pa., New Kensington, Pa., and Warren, O. In the last two cases, P. J. Freeman, of the Pittsburgh Testing Laboratory, had charge of the tests and recorded the temperatures with checked electrical pyrometers.

In New Kensington the duration of the fire was one hour and 30 minutes, and the maximum temperature obtained was 1,715° Fahr. While the fire was at its height water from a fire hose was turned on the inside of the building to subject the block to the most severe conditions. After the fire was extinguished a close examination showed that, except for a very slight amount of dehydration on the surface, the block were entirely uninjured by fire or water.

This test demonstrated the insulating qualities of cinder block. Two walls of the building were built of solid cinder block, 4 in. thick. Even though the temperature on the inside rose to 1,715° Fahr., the temperature on the outside of the 4-in. slab was never higher than 120° Fahr.[1] This temperature was recorded by an accurate thermometer placed against the wall and housed to protect it from atmospheric temperature. The block were laid in a cement-lime mortar and in less than 20 minutes after the fire started the mortar itself was so hot that one could not touch it without being burned. Yet at no time did the cinder block become so hot that it would burn one's hand.

The duration of the fire in Warren, Ohio, was one hour and 20 minutes, and the maximum temperature 1,650° Fahr. Water from the fire hose was turned on the fire as soon as the maximum heat was reached. The block were uninjured. It is interesting to note that a length of clay flue lining, which was placed beside some cinder Multiplex chimney block in the fire, cracked in many places, while the cinder chimney block were uninjured.

The buildings in both Warren and New Kensington have been inspected by a number of prominent engineers, building commissioners and architects, who agree that cinder block has earned a very important place among permanent building units.

Cinder Block Reduce Cost of Building

While building departments, housing experts, chambers of commerce and others are casting about for some method for reducing the cost of building without in any way reducing the structural safety or sanitary requirements for buildings, it is particularly fortunate that such valuable information regarding the usability of cinder block has been brought to light. In nearly every town in the country of over 30,000 people, there are hundreds of tons of vitreous, bituminous and steam boiler cinders that can be turned into a very economical building material. In the cities the size of Chicago, Detroit and Cleveland there are literally mountains of cinders for which there is practically no market, and which frequently are used for filling in waste, and that is available for home building.

Cinder block construction is economical because, first, the block cost less than other permanent materials; second, suitable cinders are available nearly everywhere; third, they are very light and can be laid up quickly, the ratio of the weight of cinder block to common brick masonry is about 32 to 60.

Specifications

At the present time the only set of specifications available covering concrete building units is the American Concrete Institute standard No. 10, adopted April 10, 1917, which provide for a crushing strength of 1,000 lbs. per sq. in. on the gross cross sectional area, and a maximum absorption of 10% on 48-hour immersion. Unless special specifications are drafted covering cinder block, there is no chance to take advantage of this proven reliable, economical building material. If an attempt is made to make cinder block meet the present A. C. I. specifications, two of the chief properties of cinder block will be lost, namely, insulation and fire resistance. Cinder block are excellent insulators, because they are porous and they are very good fireproofing material, largely because they are good insulators. Any attempt at density partially destroys the insulating properties.

The progress that has been made during the last year on the experimental side of cinder block warrants the claim that separate specifications should be drawn up covering cinder block.

It has been suggested that the crushing strength of cinder block should be 600 lbs. per sq. in. of gross cross sectional area, and the maximum absorption 20% on 48-hour immersion. The allowable working stress could be 60 lbs. per sq. in. on the gross cross sectional area of the wall. This would provide a factor of safety of 10 as against a factor of safety of 5 as now recommended by the American Concrete Institute for ordinary concrete block. These suggested specifications would permit the use of cinder block within strict limitations for two and one-half or three-story construction. Probably the specifications should include provisions regarding the amount of unburned coal and the percentage of material passing a 100-mesh screen. It has been pretty definitely proven that up to 15% of unburned coal will not be injurious to cinder concrete. It is doubtful if an aggregate grading suitable for ordinary concrete will be suitable for cinder block. A special grading would have to be worked out for cinders.

Surface Treatment

Cinder block may be faced with any kind of special aggregate. They also make a most excellent backing for portland cement stucco or they can be faced with brick. Any of these surface treatments combines architectural beauty with economical utility, and this is what home owners want.

Cleveland Building Exposition Postponed

The American Building Exposition, originally scheduled to open January 4 in the new Cleveland Municipal Auditorium, has been postponed until February 22nd, because of the failure to have the building ready by the first of the year.

Commercial, factory and home construction and equipment will be featured in the exposition, which will last eleven days.

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[1] It is pointed out by a laboratory man to whom this test was reported that while the results may justify a most optimistic view the temperature measurement is very difficult and 120° seems lost.—Editor.

7 Years' Experience Building Concrete Houses[1]

BY FRANCIS F. WILSON
CONCRETE HOUSE BUILDER
ROCKVILLE CENTRE, N. Y.

In every building operation, even the erection of a modest suburban home, some hard thought is necessary for a successful completion.

The average buyer in this locality comes from a city house or apartment, the construction of which is of masonry, and without thought the buyer unconsciously assumes all construction to be solid and enduring and is influenced almost solely by the obvious features such as built-in furniture, mirrors, and other trimmings, in his decision.

Trading on this fact, many houses were erected and sold, during the press of the last two years, in which a world of imperfections were concealed. The buyers are now finding this out and talking of how badly they were taken in. The buyer of today is timid, wants a good house, but does not know how to judge one.

The purchase of a home is to most people an investment of first magnitude. Frequently entire lifelong savings are represented. A mistake means great loss.

The question is, to find a house of honest value, permanence, comfort and beauty. I believe the monolithic, reinforced concrete dwelling answers every one of these requirements. Its solidity, enduring qualities, freedom from vermin and need of repairs, coolness in summer, warmth in winter, with less fuel consumption, fire-safeness, economy—fulfill every demand.

Concrete, we all know, is not a new construction material—it is new only in its application to home building. In the past, the methods used for house construction made concrete expensive; now we can build at the cost of frame. It makes a very attractive house and seems to grow more beautiful under the hand of time. Statistics tell us that the depreciation is more rapid for frame construction than any other class of construction, about 3% per year beginning as soon as finished. The depreciation of masonry construction is figured at nothing the first five years, and then 1% annually.

Assume two dwellings standing side by side, identical in size, plan, finish; one is frame, the other of concrete; the value of each $9,500 ($1,500 for plot, $8,000 for house). At the end of 10 years the frame house value will be $5,600, while the concrete house will be worth $7,600. The superior quality of the concrete house will also add value to the plot. The concrete dwelling will retain a higher loan and sales value for generations. When I first began to specialize in concrete dwellings, seven years ago, the loaning institutions were quite shy, now they grant their superiority.

When I say concrete dwelling, I mean one wherein the exterior and interior walls, the floors, the stairs, in fact, the whole house, except roof, is of poured reinforced concrete, the roof of timber and fire-resistive shingles.

The suburban home must not be confused with nor compared with industrial housing. In suburban work no two dwellings can be alike, unless located far apart, then the form work, engineering, in fact, all detail is much more intricate, each dwelling requires the equivalent of perhaps half a dozen industrial houses. The systematized quantity figures of industrial work cannot be applied to individual suburban work.

With an experience dating back to 1891 and the past seven years devoted to concrete exclusively, I feel I can speak with some authority.

I can get sand and gravel locally, therefore the transportation item is small on the bulky portion. The doors, windows, etc., I get from factory, the skilled labor there being concentrated; my labor is largely common, a really scientific allotment of labor and materials. In my frame construction experience it used to take an average of two and a half to three months to complete a seven or eight-room dwelling, and I can erect a monolithic dwelling of equal size and equipment in a like period.

I am now developing a small tract and will erect about 25 homes, the majority of which will have six rooms and bath, oak floors, mahogany finish doors, enameled trim, water, gas, electricity—plot, 40 x 100; selling price, $7,500.

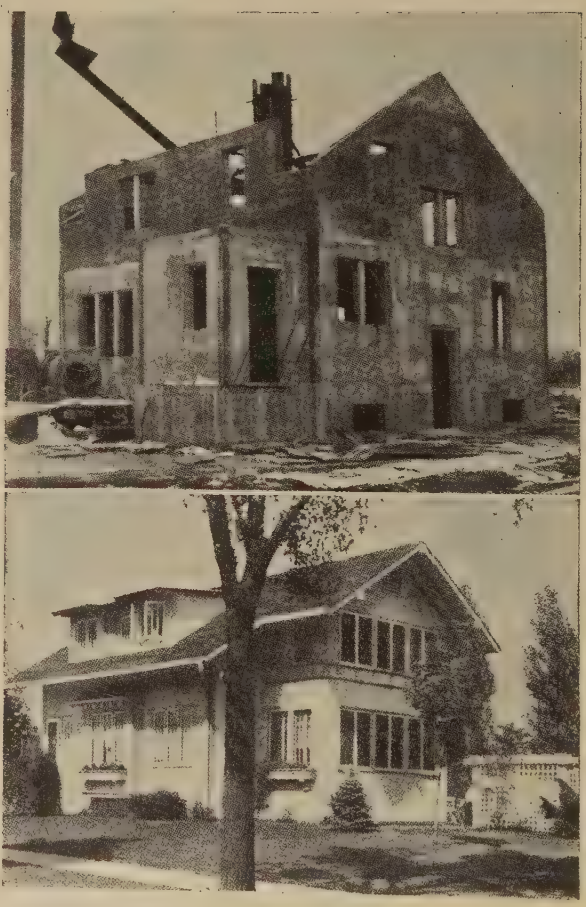
I will have a few dwellings having seven and eight rooms and bath, one of which I have just finished pouring. It is described as follows:

Basement—Laundry, storage room, fuel room, heater room.

First Story—Tiled vestibule, stair hall, with coat closet, living room with fireplace, dining room, breakfast nook, kitchen, entry, with place for icebox, glazed sun porch.

Second Story—Hall, tiled bath, three nice large bedrooms, large closet in each, linen closet in hall, glazed sleeping porch or children's room.

Steam heated throughout, including porches; gas range, electric light, water and gas. Size, 25 x 28, and porches 8 x 16. The location is 15 minutes' walk from



AT THE TOP, THE SHELL OF MR. WILSON'S MOST RECENT JOB—WHEN COMPLETED IT WILL LOOK LIKE THE LOWER PICTURE railroad station. The selling price of this house on a corner plot, 68 x 125, is $11,500.00.

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[1] Mr. Wilson's work has been described in detail in CONCRETE in previous issues.

In constructing these homes I make exterior walls and interior bearing walls 8 in. thick, partitions 4 in., and some of trussit, and cement concrete floors 5½ in. thick, with wood sleepers to receive the finish oak floors. I pay common labor $5.00 per day, skilled $8.00 to $10.00, cement $2.09 per bbl., pit-run gravel $2.00 per yd.

I have set the forms, placed steel reinforcing, set window frames and rough door bucks, placed concrete, stripped forms, for an 8 in. wall at a minimum cost of 35 cents and a maximum cost of 45 cents per sq. ft. The purchaser of one of these homes, after a look outside and one inside, can see everything he is buying, nothing covered up, every wall solid. His purchase price will be total cost; his upkeep microscopical. Truly a satisfactory business transaction.

Commerce Dept. Investigates Concrete Houses

By J. C. Pearson
Chief Cement Section
United States Bureau of Standards

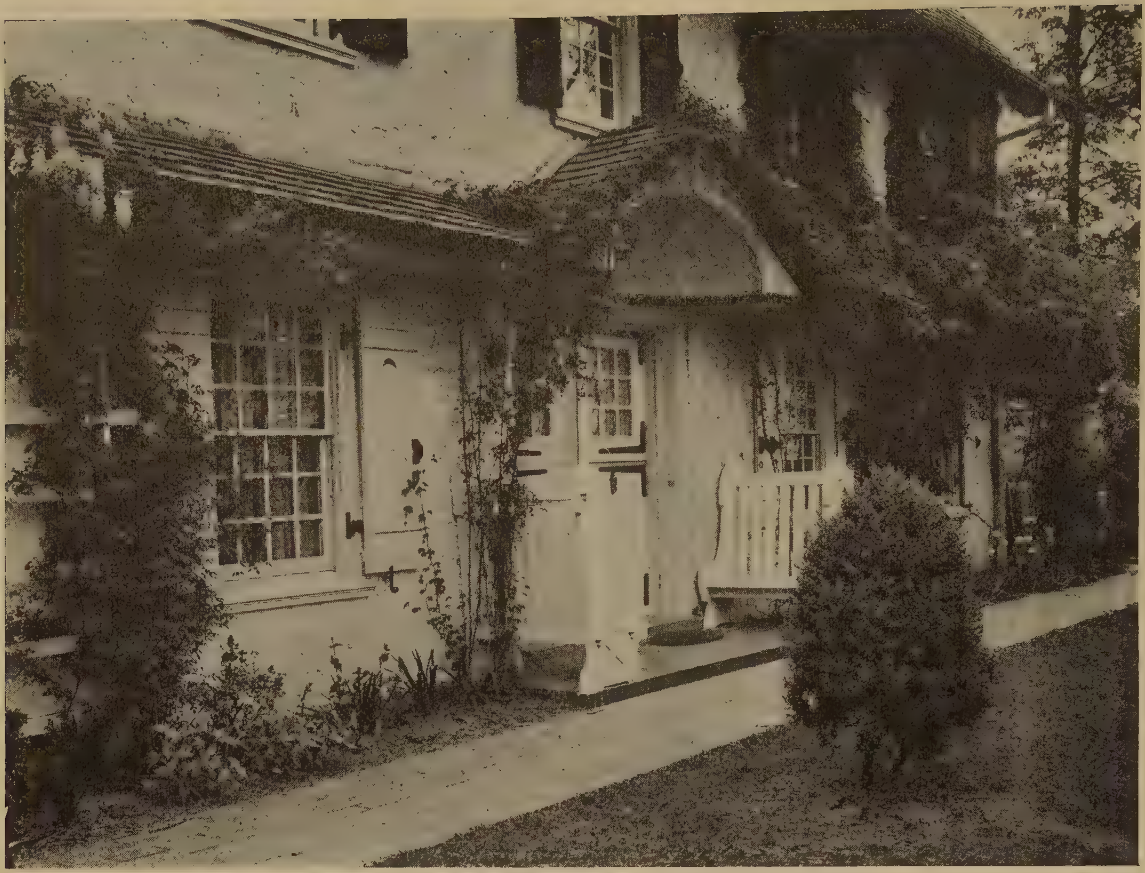
In connection with the study of building codes and small house construction by the Department of Commerce during the past year, the Bureau of Standards has made a preliminary survey of concrete houses. The purpose of this investigation is primarily to encourage the building of fire-resistive houses, and to indicate the place which concrete has, or should have, in this class of construction. It is intended eventually to include studies of other building materials along similar lines, but a beginning has been made with concrete, as the use of this material for house construction is newer than that of frame and masonry, and less information is generally available in regard to the feasibility of using concrete for this purpose.

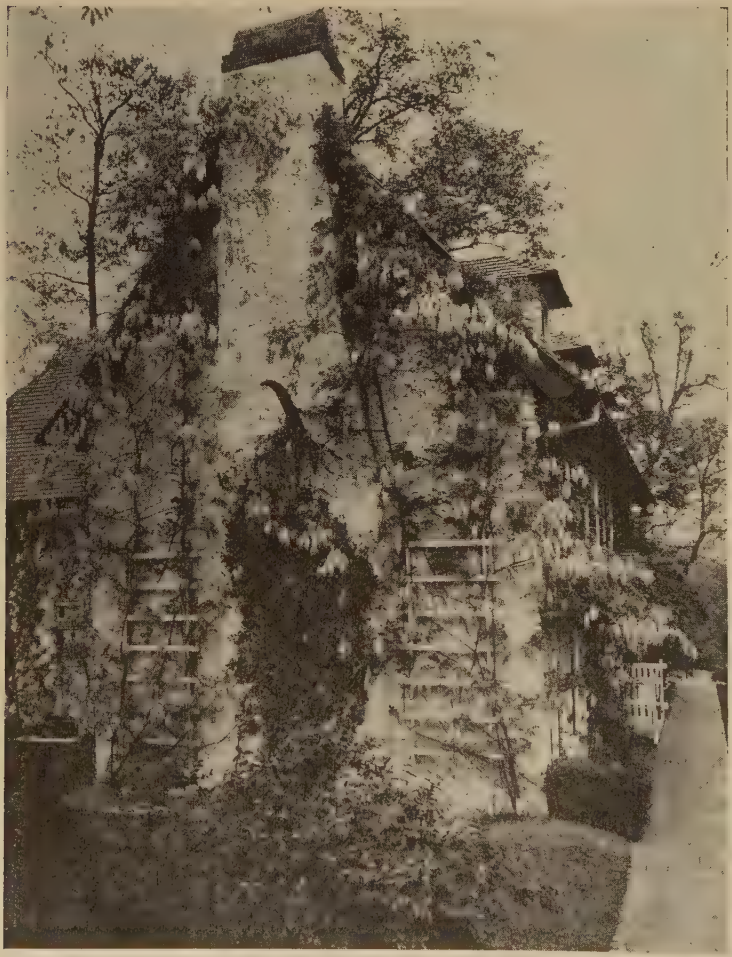
Field work was begun in October, 1921, in which inspections were made of the larger concrete housing projects, and of many smaller groups and individual houses. The more important operations which have been inspected to date include the well known Sage Roundation Homes at Forest Hills, Long Island, constructed of precast slabs and monolithic concrete; the monolithic cottages at Manhattan Beach, Coney Island, built with Lambie steel forms, also the monolithic houses at Donora, Pa., built by the same system for the American Steel & Wire Co.; the Ingersoll houses at Phillipsburg, N. J., poured complete in a single operation; the Hueber monolithic houses at Syracuse, N. Y., built with combination wood and steel forms, and having all reinforced concrete floors; the Kate Gleason houses at East Rochester, N. Y., monolithic construction throughout except for roof and trim; the Ballinger and Perrot houses at South Ardmore, Pa., of concrete frame and stucco; the Aiken houses at Takoma Park, Maryland, constructed of entire wall units precast and set in place with special machinery; the Morrill houses at Virginia Highlands, Va., poured in place in horizontal sections; the Van Guilder houses of monolithic double wall construction at Johnstown, Pa., built by the Cambria Steel Co., also similar houses at Youngstown and McDonald, Ohio, built by the Carnegie Steel Co.; the Straub cinder block houses at Apollo, Pa.; the group of large precast unit houses at Youngstown, Ohio, built by the Unit Construction Co. for the Youngstown Sheet & Tube Co.; the Donaldson houses at Youngstown, Ohio, built with metal lath forms; the Hydraulic Steelcraft Co.'s houses near Cleveland, Ohio, built with steel forms; the Fellgren monolithic houses in Chicago and vicinity, built with wood forms, and the large hydrostone block projects at Mooseheart, Ill., and Morgan Park, Duluth, Minn.

Owing to the lateness of the season, not many concrete houses were observed in actual process of construction, but it is very desirable that the present investigation include a field study of building operations, in order that the advantages and disadvantages of the various systems may be better determined. A study of this sort would be justified if it resulted only in outlining a basic plan for handling materials and labor, more or less applicable to all types of concrete house construction, that would make for greater economy. In fact, the impression has been gained that the chief problem in concrete house construction is that of reducing costs. In the case of the very great majority of the houses which have been visited, there is little fault to be found with the finished product, both the builders and the occupants are satisfied with them. It seems to have been well demonstrated that the concrete house has as much in its favor as any other type. Especially in connection with small house construction, the properly designed concrete house, in which concrete is used to meet the chief structural requirements, offers the maximum in fire-resistance, stability, appearance, and comfort, and the minimum of insurance, maintenance and depreciation costs. On this basis the concrete house is entitled to maximum value as compared with other types, but it will be difficult to convince the average prospective home owner that he should invest ten or twenty or thirty per cent more in the building of a concrete house on the ground that he will be better satisfied and that the additional cost will be saved to him in the future. It is this cost differential that must be reduced by concerted action on the part of those who are interested in the development and improvement of this type of construction.

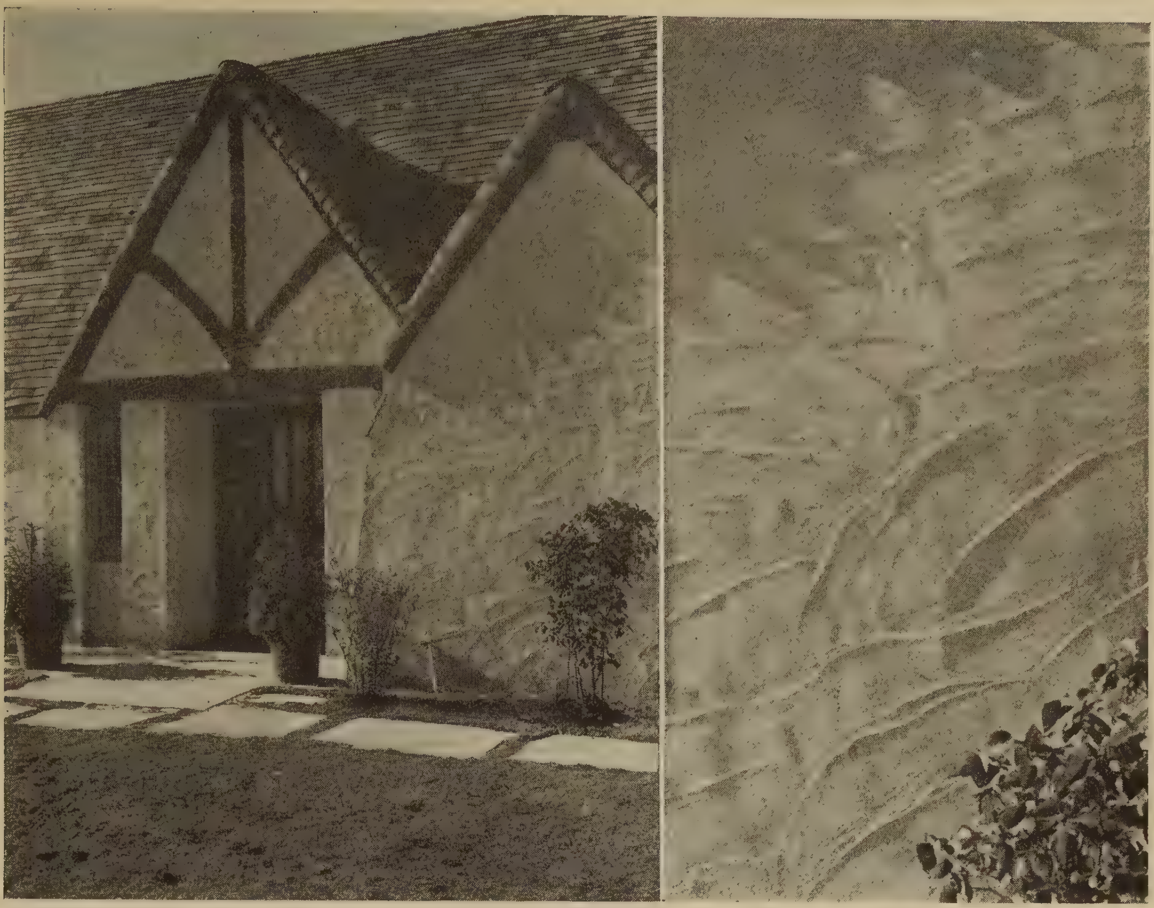
In connection with the all-important question of costs, concrete has thus far been found better adapted to large housing projects than to small groups or individual houses. It is, of course, true that whatever building materials are employed, greater economies are possible the larger the building operation, but generally speaking, concrete is at a relatively greater disadvantage in respect to the small operation. It is an open question whether monolithic concrete or the small concrete unit—tile, brick or block—has the better prospect of meeting the individual house problem. The opinion has been formed that the small units will have the advantage in localities where highly efficient plants for their manufacture exist, but such a diversity of factors influence the selection in any one locality that both these types will probably find a place, and become widely distributed as the means of building them economically become more generally available.

Up to the present time progress in concrete house building, especially of the monolithic type, has resulted largely from individual effort. Numerous systems of forms have been devised, many of them patented, and some of them have rewarded the ingenuity and diligence of their inventors with fair returns. But the time is approaching when co-operative action will supplant individual effort in the line of development; the former must be depended upon to work out systematized and standarized methods, tending to greater efficiency and lower costs, whereas the latter will more and more be removed from the promotion field and turned into the direct production of houses.





WALTER SMEDLEY, ARCHITECT, STEPHEN GIRARD BUILDING, PHILADELPHIA, DESIGNED THIS HOUSE AT PAOLI, N. Y., MORTAR WAS ROUGHLY TROWELED OVER FIELD STONES, PURPOSELY LEAVING THE INEQUALITIES CAUSED BY THE ROUGH BASE



BLOODGOOD TUTTLE, ARCHITECT, 7 WEST 34TH ST., NEW YORK CITY, DESIGNED THIS HOUSE AT PELHAM, N. Y.—IT IS VERY EVIDENT FROM THE PHOTOGRAPHS HOW THE SURFACE EFFECT WAS OBTAINED IN THE STUCCO, THIS BEING TROWELED WITH A FREE AND NATURAL MOVEMENT, WITH NO FOLLOW-UP, THAT IS, WITH NO ATTEMPT TO SMOOTH OUT THE INEQUALITIES—THIS RESULT HAS BEEN IMITATED SUCCESSFULLY BY THE ATLAS PORTLAND CEMENT CO. ON DISPLAY PANELS IN ITS OFFICES

Stucco—Its Myriad Textures

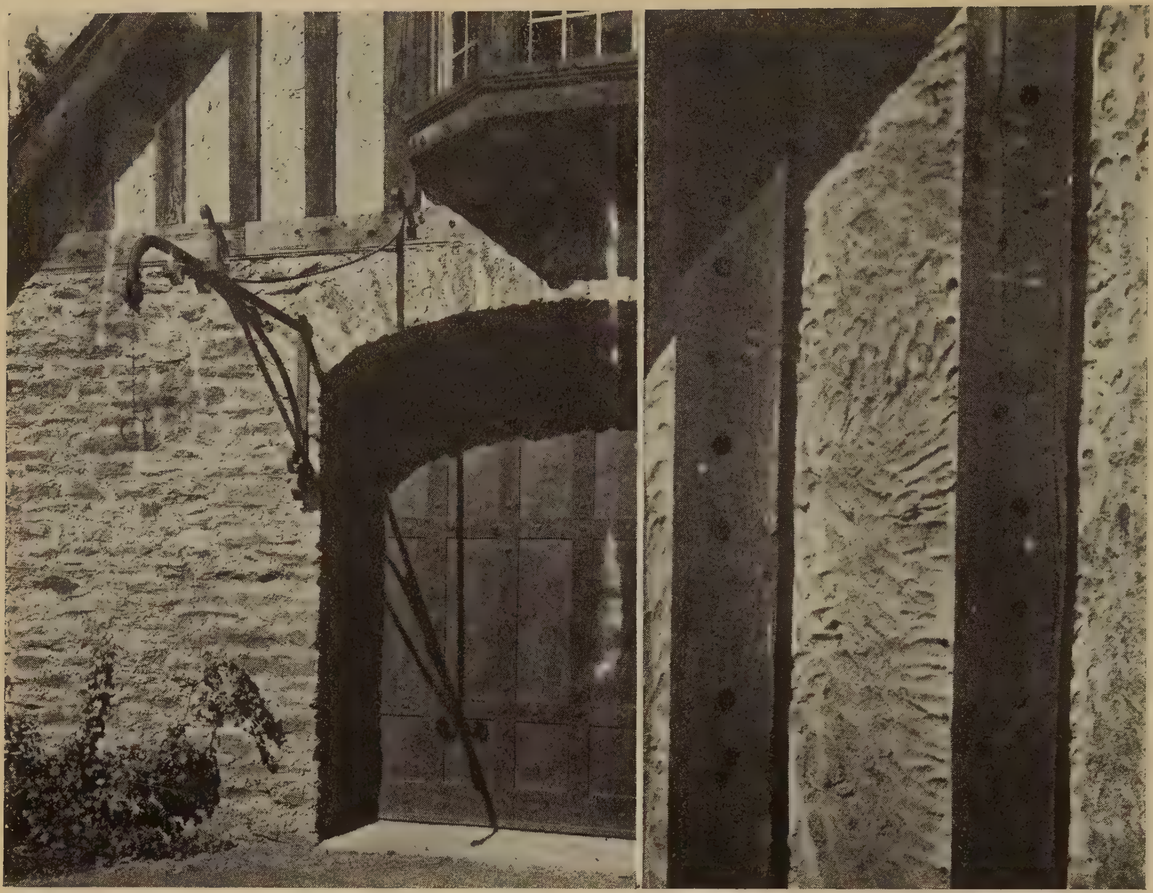
BY E. D. BOYER
ATLAS PORTLAND CEMENT CO.

In stucco is found a material that lends itself most delightfully to individuality. while still retaining its beauty and without becoming bizarre. For it must always be borne in mind that stucco, during its application, is a plastic material and during this period of plasticity it may be worked and fashioned into a never-ending variety of textural effects.

All this variety, with few exceptions, is obtained in the finish coat. The base coats are structural. They supply the strength and weather resisting qualities. The finish coat is for the ornamental or architectural effect. Therefore, the base coats are the same for all varieties of textural effect and it is on this structural base that the plastic finish coat is placed and worked. It is immaterial upon what foundation the base coats are placed; it may be either metal lath on frame construction or brick, hollow tile or concrete block in masonry construction. Therefore, for these textural effects no change in method is involved until the last or finish coat is applied.

There is one possible exception to this, and that is where it is desired to obtain the rough effect of stucco over a wall of irregular field stone. In this case the base coats are mixed and applied in the usual method, except that instead of bringing the second coat to a smooth surface, it is purposely left rough.

The finish coat, in which the textural effects are to be obtained, varies in no way in its proportioning and mixing from that which is ordinarily applied for the usual stipple or rough cast finish. The effect is entirely in the method of applying. And in this lies the difficulty of explaining how these different effects, as illustrated, are secured. A few feet of moving pictures of the application would show instantly the method, but explaining in words is difficult. And yet, the actual manipulation is not difficult. Many are secured by using only the steel trowel, but endless variations are possible by different motions of the arm and the position in which the trowel is held. The detail photographs usually give the key to



The Claire A. Briggs House at New Rochelle, N. Y., Henry G. Morse, 101 Park Ave., New York, Architect, Was of Prepared Stucco, with Portland Cement Base—The Finish Coat Was Put on by Italian Laborers, Who Used Their Bare Hands in the Application—This Is Quite Apparent from the Illustrations, Particularly the Detail View of the Surface

one who has had experience in applying stucco and with a little experimenting, nearly any one of the textures illustrated can be obtained.

The main point, however, is not to imitate the textures shown in these photographs, but by some experimenting along this line, to evolve a particular effect that is attractive and distinctive.

Photographs, while they give a reproduction of the textures which is true in one sense, fail to give any indication of the color effects. These can be varied in almost as endless variety as the textures. Particularly is this true when white portland cement is used, for here the cementing material allows the true color value of the aggregate to appear. With the white cement endless shades and tones of buffs, creams and browns are obtained by using only the properly colored sand with the white cement. And practically all sands are colored. Some, if not most, of the very attractive tones, are secured with just the ordinary common building sand, sold locally for concrete work or for making mortar for laying up brick work. Therefore, the cost of such coloring is low as the white cement enters only into the finish coat. Or, if no properly colored sand is locally available, it can be cheaply secured as the amount required for this finish coat is comparatively small.

Stucco has passed that stage where it might be likened to a "permanent coat of paint." It is now a material of recognized individualistic possibilities. Houses are now designed that would lose all their charm if they showed an exterior of anything but a texturally treated stucco.

Road Congress

The Twelfth American Good Roads Congress will be held at the Coliseum, Chicago, Ill., January 16-20, 1922, under the auspices of the American Road Builders' Association.

There will be sessions devoted to the following subjects: Bituminous roads; Portland cement concrete roads; Common roads; Highway financing; Highway traffic and highway transportation, and Highway research.

In the session devoted to concrete roads these subjects will be considered:

The Selection of the Mineral Aggregate for a Portland Cement Concrete Road, by John H. Mullen, chief engineer State Highway Department of Minnesota; Design of Concrete Roads for Heavy Traffic, by W. D. Uhler, chief engineer Pennsylvania State Highway Department; Inspection and Control of Materials for Concrete Roads, by R. W. Crum, State testing engineer, Iowa State Highway Commission; Importance of Surface Finish and Methods of Control, by H. E. Breed, consulting engineer, New York City; Single Track Concrete Roads for the Average County, by P. C. McArdle, county highway superintendent, Vermilion county, Danville, Ill.; Pavement Widths for Highways Serving Large Cities, by Edward N. Hines, chairman Board of County Road Commissioners, Wayne county, Detroit, Mich.

Contractors Find Stumbling Blocks in Joint Committee Report

By the Editor

Contractors who are digging into the new progress report of the Joint Committee on Concrete and Reinforced Concrete are finding provisions in it which, if they become the virtual law of reinforced concrete construction, through adoption by the several technical organizations from which the Joint Committee was formed, may work radical changes in construction practice, effect materially the cost of structures and place upon the contractor a more serious responsibility.

The Joint Committee has without doubt, a fight on its hands. The report will be up for discussion at the convention of the American Concrete Institute at Cleveland, February 13 to 16.

The report is voluminous—73 closely printed pages. It is not practicable to present it in these pages. This very situation makes it easy for contractors to let such a report pass unnoticed. When, in the absence of thorough consideration such a report is adopted, objectionable features are only apparent to contractors when they find these features in specifications under which they are called upon to do a job.

The Joint Committee is made up of representatives of the American Concrete Institute, American Society of Civil Engineers, American Society for Testing Materials, Portland Cement Association, American Railway Engineering Association. The committee has gone on record in opposition to the publication of any written discussion by its members of the provisions of the report.

This denies to readers of this magazine an article which would have been of very great value in presenting concisely the outstanding features of the report from the viewpoint of the committee itself, and facilitating the discussion which any such report deserves and without which it should not be adopted.

An outstanding feature of the Joint Committee report is provision (Section 28, Proportions) for an alternate method of specifying the quality of concrete by which instead of, or in addition to, naming the proportions of the mix, the engineer may require the contractor to furnish concrete meeting a specified strength at 28 days.

Appreciating the far-reaching effects of such a provision, Henry C. Turner, president of the American Concrete Institute, has effected the organization of local committees of contractors in New York, Chicago, Philadelphia, Boston and elsewhere, for the purpose of developing intelligent and thorough discussion at the Institute convention next month.

While the Joint Committee report has been in the hands of members of the co-operating societies since June last, there was at first the usual inertia in developing such a study of it as would bring to light sharp differences of opinion as to its provisions.

These local committees, however, once having their attention centered on such provisions as specifying concrete by strength, have been actively interested and some of the criticism prepared by the New York Committee is here presented as a means of bringing to the attention of readers of this magazine the issues upon which the Joint Committee report will undoubtedly prevail or be defeated in its present form.

The magazine Concrete is in the position of being in favor of the specification of concrete by strength but in favor also of developing the legitimate opposition to such a specification. Only by developing the opposition can a workable practice be found. The specification of concrete by strength is not a provision to be "put over" on contractors. It is something on which contractors should if possible be "sold."

The greatest single obstacle of progress for concrete construction, aside from the natural human inertia to be overcome in the acceptance of new material, is the well-sustained criticism that concrete, being a job-fabricated or job-manufactured material, is an extreme variable, by reason of many changing factors. Thus, designs are not economical. A 1:2:4 mix makes good concrete or bad concrete. The 1 (cement): 2 (sand): 4 (stone) are but three of many factors and the *two* (representing sand) and the *four* (representing stone) are in each case but one of several factors of the material—the *quantity*.

We know how to make concrete of a predetermined strength and quality—within reasonably narrow limits, limits sufficiently definite to permit careful and conservative and at the same time economical design.

The real problem is the application of these laboratory determinations to job practice.

When the designing engineer can count definitely on concrete of a given strength he can design more economically, concrete buildings will be more in demand and concrete contractors will have more to do.

The problem is the means of control to the end that the quality of a job-made material shall be of as constant and as definite a quality as structural steel. The steel producers years back fought and then succumbed to and gloried in these same labored efforts towards standardization.

The report of the New York Committee of contractors on provisions of the Joint Committee Report is signed by J. G. Ahlers, Barney Ahlers Construction Corp.; G. E. Escher, White Construction Co.; N. M. Loney, Thompson-Starrett Co.; M. M. Upson, Raymond Concrete Pile Co., and D. H. Dixon, Turner Construction Co. The report practically in full is as follows:

Report of Committee Appointed to Study the Provisions of the Tentative Specifications for Concrete and Reinforced Concrete Submitted As a Progress Report of the Joint Committee.

The committee submits comments on certain sections of the Specification referring to matters which it feels are of major importance as affecting the construction of buildings and similar works in reinforced concrete.

Section 2—Column Capital—The meaning of "monolithic" should be defined. It should not be necessary to concrete the column and flat slab on the same day.

mens; —6

Sections 3—Quality; 4—Strength; 5—Tests of Field Specimens; 6—Portland Cement—The provisions of these sections should, we feel, be modified to conform to certain changes recommended in our consideration of Section 28.

Sections 20 to 25 inclusive—Metal Reinforcement—Your Committee recommends that these sections be referred to a special committee having more detailed knowledge of the manufacture and testing of steel and iron. We feel that the specification of cold drawn wire for column spirals, etc., may be unnecessarily restrictive.

Section 26—Unit of Measure—As a bag of cement does not contain 94 lbs. in Canada we recommend that 94 lbs. of cement be considered as one cubic foot. The section to be redrawn to remove the inference that a bag of cement is always 94 lbs. in net weight.

Section 27—Method of Measuring—We recommend that the specification provide for measurement by volume without reference to measurement by weight. Apparatus practicable for measurement by weight is not readily available on the usual run of work. Departures from accepted practice should not be included as alternates in a standard specification intended for general use. Where alternates are allowed there is sometimes a tendency on the part of those not having a thorough knowledge of the industry to use the alternate which seems to provide the most scientific and exact determination without appreciating the difficulty or extra cost involved.

Section 28—Proportions—This section gives three alternate methods of specifying the proportions in which the cement and aggregates are to be mixed. The first alternate attempts to specify both the proportions in which the concrete is to be mixed and also the strength test cylinders are to have at 28 days. The second alternate leaves the proportioning of the concrete to the contractor but requires him to guarantee the strength of test cylinders at 28 days. The first alternate is impracticable of operation without recasting its provisions so as to make them equivalent to those contained in the second alternate.

We recommend most strongly against the adoption of alternates one or two, and feel that should the Joint Committee publish further tentative reports these alternates should be omitted as likely even in such unapproved form to work grave injury.

Alternates one and two give the engineer the option of specifying concrete by strength rather than by proportions. We believe that at the present time attempts to exercise such an option in any but exceptional cases may prove very unfortunate.

We realize that under present conditions some economic waste results from the fact that wide variation in strength (as shown by compression tests on cylinders at 28 days) occur with our present methods, and if we had more fully developed means of closely controlling the grading and consistency of the mix it would be desirable to attempt to mix concrete of varying proportions to more closely approach a specified strength, although even then it should be the function of the engineer rather than of the contractor to design the mix.

In the present state of the art it would only lead to dispute and lawsuits, if the engineer should attempt to burden the contractor with the necessity of constructing work for which he could not legally collect if samples taken from the previous work should fail to come up to the specified strength after one or more succeeding portions of the work were already superimposed on the alleged defective portion.

On public work where the engineer is closely bound to a literal interpretation of the specifications the adoption of these clauses would force the engineer to condemn work he knew to be good when through faulty manipulation of test specimens the test specimens failed to test up to the requirements of the specification. These clauses would operate to limit competition on public work because contractors would be disinclined to figure under them on work where the effect of sinister influences might be feared. We believe that under certain conditions the clauses we are considering are capable of grave misuse.

If these alternates are adopted it will be necessary to revise the Committee Recommendations on cement since it will be manifestly unfair to compel a contractor to sell concrete by compressive strength unless the manufacturer of the cement is also compelled to sell cement by compressive strength, something for which the proposed specifications do not provide.

The provisions of Chapter III are dependent on the adoption of one of the first two alternates of Section 28 and therefore if our recommendations that these alternates be eliminated are accepted it will become necessary to revise the provisions contained in Chapter III.

The reliability of slump tests as specified in Section 3 and of compression tests on cylinders as specified in Section 5 is open to serious question especially when operated under job conditions, as will be more fully explained in a supplementary report we are now preparing.

We question the propriety of judging a concrete entirely on the compressive strength of test cylinders at 28 days. We believe that this will be an injustice to certain cements that do not give high compressive tests at 28 days, but do test well at later periods.

We earnestly recommend that all contractors engaged in reinforced construction construction study the methods devised by Prof. Abrams and others for the scientific determination of concrete mixes, giving special attention to the control of water ratio by the installation of proper water measuring devices, by the regular use of slump tests, etc. To assist in this work we have prepared and will distribute memorandums giving:

(1) Data on the design of concrete mixes.
(2) Field methods for the determination of fineness, modulus, slump and compression tests, etc.
(3) Devices for the accurate measurement of water.

We also recommend that we keep in mind the desirability of the development of machines and field testing appartus, which will preferably reject surplus water unavoidably present in the mix due for instance to varying moisture contents of the aggregate or in lieu of this easily handled field apparatus for testing the consistency of the mix. There should also be developed easily manipulated screens for testing the grading of the aggregate and other means which may be devised for predicting at the time the mix is made the final compressive strength which will be developed at 28 days. Several independent developments along these lines are under way and no doubt the art will continue to improve along this line. As the developments take place their commercial application will depend upon the extra expense required for greater amounts of equipment, increased time for mixing and increased difficulty in placing by chutes, etc.

By further study it may be possible so to advance the art of mixing and testing concrete as to make it desirable to include such methods of proortioning as are contained in the first two alternates. Until that time comes, however, we are convinced that a standard specification should contain only one method for proportioning. That method should be set forth in the third alternate by a statement of the proportions by volume in which the cement, fine aggregate and coarse aggregate are to be mixed.

In the third alternate we recommend that the reference to Table 4 be eliminated and that the wording be changed to provide that the Engineer shall change the proportions when he considers it desirable to do so, with adjustment of the contract price to be made if the cost of the work is increased or decreased by such change.

Section 31—Time of Mixing—This section requires that the material remain in the mixer not less than one and a half minutes. This frequently would mean an increase of about 50% over the amount of equipment now necessary and we recommend that this time be reduced to three-quarters of one minute or to one minute, as the best information we have indicates a gain of about 10% in strength when the mixing is increased from one-half minute to one minute, and a further increase of only two per cent when the time of mixing is increased from one minute to one and one-half minutes.

We would also recommend that a clause be inserted in this section modifying the time the material is required to remain in the mixer when the method of placing is such as to improve the quality of the concrete during the operation of placing as for example during the operation of chuting when the material is dumped into flood hoppers and rehoisted.

Section 40—Protection—We suggest that the words "where practicable" be added to this section, so that the section will then read: "shall where practicable be kept thoroughly wetted."

Section 41—Cold Weather—We recommend that this section which broadly prevents the addition of salt or other chemicals to prevent freezing, be modified so as not to shut the door on the developments which indicate that for certain work where electrolytic action is not to be feared such chemicals as properly prepared calcium chloride prevent freezing cheaply and without damage to the work.

Section 48—Coffer Dams—We recommend that this section, which as now written prohibits pumping in coffer dams while concrete is being deposited, be modified to permit necessary pumping in such manner as will not cause the washing away of mortar.

Section 54—Workmanship—We recommend that the prohibition against the use of metal within one inch of any surface be modified to apply to exterior surfaces only.

Section 67—Fire Protection—We believe this section as written will prevent the further use of quartz gravel concrete, because of increased cost due to the requirement that where quartz is used the fireproofing must be increased one inch and a metal mesh must be placed one inch from the outside surface. As drawn this section seems to apply to all parts of a building, without recognizing the fact that columns may require a different treatment from that given slabs and walls. We doubt if this restrictive condition is necessary except for spiral columns in buildings where the fire hazard is unusually severe, and in that case it is possible that study might show a more economical method of overcoming the difficulty. The increased cost occasioned by this section, applying as it will to all buildings erected in cities where quartz gravel is the cheapest available aggregate, must be compared with the greater fire loss that will occur in the comparatively small number of such buildings that will be subjected to fire.

We recommend that this section be referred to a special committee qualified to study the results of fire tests, results of fires in buildings, etc., and then submit a special report on the provisions contained in this very important section.

Section 79—We recommend that this section be modified to permit the use of integral waterproofing compounds under proper restrictions.

Section 80—We believe that hydrolithic waterproofing can frequently be used to excellent advantage and therefore we recommend that a section be introduced allowing the use of hydrolithic waterproofing under proper restrictions.

Section 94—Many excellent floors have been constructed by sprinkling a mixture of dry sand and cement on the surface of the concrete. Some of the largest manufacturing companies of the country now specify this method for buildings erected for their own use. We feel that this method should not be prohibited, as might be inferred from a reading of Section 93.

Section 95—Two Course Work—We feel that to require the placing of a monolithic wearing course within one-half hour after the placing of the base course is unreasonable. We recommend that this section be reworded so that the time that may elapse is made dependent on the temperature, humidity, setting time of the cement, etc. This might be done by specifying the condition of hardness the base course can have at the time of spreading the wearing surface.

Section 105, etc.—We will submit a supplementary report, containing the results obtained by estimating the cost of the various parts of the skeleton frame of a reinforced concrete building when designed under the existing New York Code, and when designed under the specifications of the Joint Committee, using concrete having strengths of 1,500, 2,000, and 2,500 lbs. per sq. in.

We will try to accompany these estimates by a memorandum describing the reasons for differences in the quantities required under the two codes, and by a study of the changes that have been made during the past number of years in the unit stresses allowed, etc.

At a meeting of the New York Committee with other New York contractors, November 30, Mr. Loney submitted a supplemental report for the Committee on Section 105, etc., containing comparative estimates of the cost of the reinforced concrete skeleton of a building designed under the New York Building Code, and under the provisions of the Tentative Specifications. This comparative estimate showed that for flat slab construction the provisions of the Tentative Specifications would make the skeleton of a building about 11% more expensive than when constructed under the New York Code. For beam and girder construction there would be only a slight difference in cost. Interior columns designed under the Tentative Specifications of the Joint Committee were estimated as about 30% more expensive than when designed under the New York Building Code.

Special attention was drawn to the fact that the Tentative Specifications require that concrete cylinders be tested as soon as they are removed from the wet sand in which they have been stored, which means that they will have a strength some 25% less than if dried for three days before testing. It is pointed out that as all unit stresses used in design under the Tentative Specifications are fixed as a percentage of the strength of the cylinders when tested at 28 days, the provision requiring testing of the cylinder when wet has a marked effect on the richness of the mix required to obtain a given strength.

It is believed by some of the contractors that it has been the general practice on engineering works to test the cylinders after drying out. This, we are informed, has been the practice of the R. W. Hunt organization. They feel that the far-reaching effects of the provision which establishes the strength of concrete as the strength of cylinders tested wet should have the very careful consideration of both engineers and contractors.

Meetings were held in New York early in December by the American Society of Civil Engineers, at Engineering Societies Building, at which the Tentative Specifications were considered.

How's Business?

Stripped of all foolish optimism and glum pessimism, the business situation at the opening of 1922 is considered by financial and industrial authorities as being very satisfactory. December activities slowed down as usual and a two months' period of "seasonal inactivity" is expected to precede a real start of good business about March 1.

The country has written off about twenty-five billion dollars' worth of inventory stock in 1921, and that our industrial fabric was able to withstand so great a strain is one of the most hopeful signs in sight.

Industries close to the consumer—like textiles—are operating at 85% of capacity or better. Industries furthest removed—like steel—are recovering. So we have the whole army of business on the march at last.

About 85% of the people are employed, savings deposits are increasing, and the farmer is gradually finding himself in a better position to sell and to buy to advantage.

All of the above promising influences are quoted on the authority of W. P. G. Harding, governor of the Federal Reserve Bank System, in his annual statement.

The Merchants' National Bank, Detroit, points to four fundamental developments in 1921 that provide ground for confidence in the immediate future:

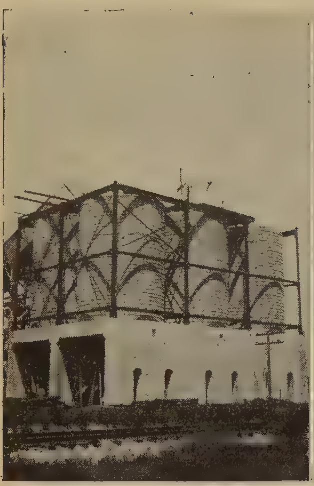
> The ending of the long and drastic price decline and appearance of stabilization, especially in raw materials; the apparent approach of world diplomatic and economic sanity; the passing of tight money, and the practical completion of readjustment and liquidation in many lines.

The construction industry is universally regarded as being in a position to reap immediate benefits from improving conditions. As a matter of fact, the building business is good right now. There has not been so great a winter slump as usual in construction. Material prices have steadied to a great extent. Money is easier. Labor is more efficient.

There are labor troubles ahead, and they will be most serious in cases where employers, now having the whip hand, are using the whip. When construction absorbs its present surplus of labor, the unions will again have the power to dictate.

December building figures show a smaller seasonal decrease than usual. Business buildings represent about 16% of the total, residential construction better than 40 per cent.

The recent federal road appropriation insures the availability of more than $150,000,000 for highway construction at once, and the influence of the Hoover employment conference is seen in the preparation being made by the states to get their road construction work started at the earliest possible moment.



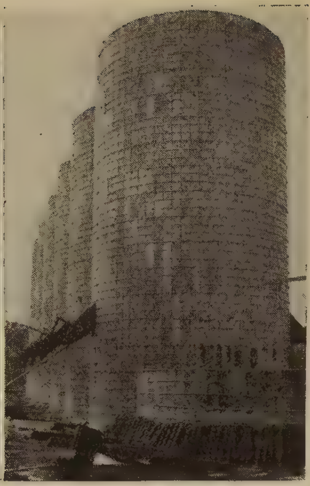


FIG. 1—(LEFT) SIX 18 x 26 FT. GRAVEL BINS BUILT OF CONCRETE STAVES BY NEFF & FRY, CAMDEN, OHIO, FOR KEYSTONE GRAVEL CO., DAYTON—CAPACITY, 200 TONS PER HOUR

FIG. 2—(RIGHT) SEVEN 20 x 40 FT. CONCRETE STAVE COAL POCKETS BUILT BY NEFF & FRY, FOR E. C. CLARK COAL CO., BATTLE CREEK, MICH.

Concrete Stave Silo Manufacturers Hold Lively Meeting

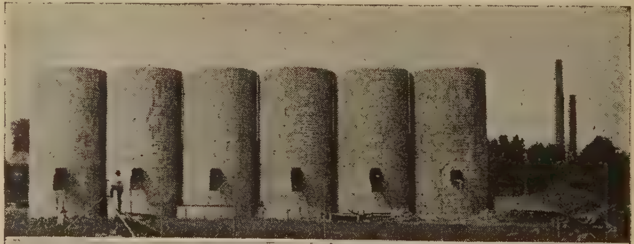
Despite the lean 1921 season for most silo manufacturers, the Sixth Annual Convention of the National Concrete Stave Silo Association, held in Chicago, December 6, 7 and 8, will stand out as the most successful meeting ever held by this organization. Manufacturers realized that they were unable to cope individually with the problems that face the silo industry at present, and that the only chance for betterment of these conditions would be through co-operative and united effort.

Dispensing with the formalities that usually usher in a convention of this kind, A. J. R. Curtis, manager of the Cement Products Bureau, Portland Cement Association, opened the meeting by proposing a broad national publicity campaign, in which not only silo manufacturers, but everyone interested in silos, would be urged to participate, including silo accessory manufacturers, silage cutter manufacturers, material manufacturers, creameries, agricultural press, county agents and bankers. His suggestion received unanimous approval, and a silo committee was appointed to organize and conduct such a campaign.

Data were presented showing that the silo market in this country has scarcely been touched. The following table indicates the number of silos of all types in the different states at present, and the potential market for silos. This is based on the number of farms having sufficient dairy and beef cattle to justify the erection of one or more silos. In California, Nevada, Arizona, New Mexico and Texas the potential market is based on dairy cows only.

State	No. of Silos Now Built	No. of Silos Needed
Alabama	150	56,600
Arizona	125	1,781
Arkansas	2,500	42,500
California	1,200	22,840
Colorado	3,000	25,300
Connecticut	2,000	6,300
Delaware	1,200	2,200
Florida	150	25,000
Georgia	150	56,600
Idaho	300	16,000
Illinois	35,000	84,000
Indiana	33,000	48,800
Iowa	23,000	91,350
Kansas	13,000	80,600
Kentucky	12,000	37,300
Louisiana	150	23,400
Maine	4,500	10,000
Maryland	500	11,000
Massachusetts	6,000	21,000
Michigan	35,000	71,000
Minnesota	18,000	90,400
Mississippi	700	37,100
Missouri	15,000	79,600
Montana	300	43,200
Nebraska	7,500	82,200
Nevada	5	2,333
New Hampshire	3,500	5,500
New Jersey	1,800	10,000
New Mexico	100	3,400
North Carolina	700	42,000
North Dakota	3,500	25,700
Ohio	30,000	92,400
Oklahoma	5,000	62,000
Oregon	2,000	42,000
Pennsylvania	30,000	82,000
Rhode Island	1,000	1,500
South Carolina	350	19,200
South Dakota	5,000	44,100
Tennessee	5,000	27,200
Texas	700	45,520
Utah	600	16,300
Virginia	6,500	38,700
Washington	3,000	20,100
West Virginia	8,000	32,100
Wisconsin	75,000	103,000
Wyoming	100	29,000
Total	500,000	2,046,800

G. I. Christie, Director of Extension, Purdue University, cited tests made at the Wisconsin Experiment Station, where it was found that by feeding an acre of corn through the silo 1,500 lbs. more milk was obtained than by feeding an acre of shredded corn fodder. Many dairymen would have to go out of business but for the cheap feed made possible by the silo. In the minds of some feeders there is still some question about the economy of silage in the production of beef. Mr. Christie says "The cattle feeding business cannot be conducted on an economical basis without the use of a silo any more than you can carry on dairying without a silo." In some tests made at the Purdue Experiment Station it was found that when shelled corn, corn stover and hay were fed it required about 13 lbs. of corn to make a pound of beef, but when silage was added to the ration and balanced up with protein, a pound of beef was produced from nine pounds of corn. Mr. Christie gave additional proof of the value of silage in placing cattle feeding and dairying on a sound profitable basis. These facts, presented by such an authority as Director Christie, were very encouraging to the silo manufacturers, because they show that the silo business must come back



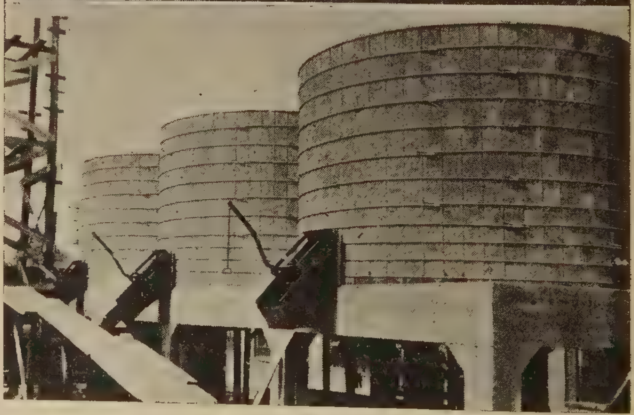


FIG. 3—ANOTHER VIEW OF THE SEVEN COAL POCKETS AT BATTLE CREEK

FIG. 4—SAND STORAGE BINS BUILT BY NEFF & FRY FOR ALTOONA BUILDERS SUPPLY CO., ALTOONA, PA.

stronger than it was before the period of business depression from which we are now emerging. The fact that American people are today using 35% more dairy products than they did two years ago, explains why dairy products are in such strong demand at good prices and why dairy farmers in general are now in much better financial condition than other kinds of farmers. Since the dairy farmer is the silo manufacturers' best prospect, the future outlook in the concrete stave silo business appears bright.

One of the chief obstacles during the past year in selling silos was the inability of farmers to borrow money to buy a silo. Generally the banker can be counted on to help a farmer get a silo, because he knows that a silo means greater farm profits and that it is a whole lot easier to pay for a silo with a silo than it is to earn the money without a silo.

H. S. Covington, of the Fort Dearborn National Bank, Chicago, explained the operation of the War Finance Corporation, which has been re-established with a billion dollar capital to help farmers get funds to carry them over the present financial stringency. This talk, together with the discussions that followed, brought out many valuable suggestions that manufacturers carried home with them to try out. It was the general opinion that this measure would prove of incalculable value to the farmer and would naturally put him in a better position to purchase a silo.

W. B. Trost, of the Waterloo Playford Silo Co., told about the concrete stave corn cribs he has erected around Waterloo, Iowa. He has developed a combination crib and granary that is fireproof. It is also ratproof. These structures are constructed entirely of concrete staves and steel. One of the recent issues of CONCRETE contained an article describing his cribs.

COAL POCKETS AND STORAGE BINS

The talk on concrete coal pockets and aggregate storage bins, by M. B. Fry, of Camden, Ohio, opened the eyes of a number of manufacturers to the possibilities of concrete staves for other construction than silos. Mr. Fry said "The silo business got so slow in our territory that we decided to go into the coal pocket and aggregate storage game." This year he erected 25 coal bins and 12 aggregate bins, some of which are here illustrated. Mr. Fry thinks that concrete stave aggregate bins will become very popular in the future. He says "There is nearly always considerable moisture in sand and aggregate, which causes bins of wood construction to decay very rapidly, sometimes in two and one-half years." Mr. Fry is justly proud of the six gravel bins he constructed for the Keystone Gravel Co., Dayton, O. The stave bins are each 18 ft. in diameter and 26 ft. high. They are supported on a monolithic concrete base which extends 17 ft. above grade and is so constructed that gondola cars can be backed underneath for loading. Trucks or wagons are loaded through chutes along the side. This plant has a capacity of 200 tons per hour. This plant has been in use since July 1 and Mr. Fry says there is not a checked stave on the job.

TESTING STAVES

An interesting diversion in the program was the talk by W. O. Brassert of the Michigan Silo Co., with factories at Kalamazoo, Mich., and Peoria, Ill., on the subject of improving the quality of concrete staves. Mr. Brassert has built a practical device for testing staves right in his plant. With this device he is able to make a transverse or beam test on the staves. The staves are supported at a point 1½ in. from each end, making a clear span of 27 in. The load is applied at the center. The beam test is very important, as it is as a beam that the load comes on a stave when erected in a silo, coal pocket or other storage structure. Although Mr. Brassert has not made sufficient tests to arrive at any general conclusions, he has made some interesting discoveries. He made up a number of staves alike except that in one batch he used a very wet concrete, in a second batch medium wet, and in a third batch stiff concrete. These were tested at 28 days.

The medium wet mix staves were 29% stronger than the wet mix and the staves of the stiff mixture were 43% stronger than the wet mix staves.

Some tests were made comparing staves made with screened and unscreened gravel. Staves made with screened gravel averaged 12% stronger.

Another series of tests is being made to determine the effect of various proportions of cement, sand and pebbles on the strength of the stave. The following table gives the results of some of these tests:

Concrete Mixtures	Strength at 28 days	Strength at 2 months, 11 days
1:2:3	976 pounds	1,327 pounds
1¼:2:3	1,076 pounds	1,489 pounds
1½:2:3	1,077 pounds	1.735 pounds
1½:1½:3	1,173 pounds	1.777 pounds

Mr. Brassert is Chairman of the Committee on Concrete Staves of the American Concrete Institute, and plans to give a report on his tests, together with tests made by the National Concrete Stave Silo Association and other tests at the coming meeting, Cleveland, February 13-16. It is proposed to make these tests the basis of a set of specifications covering test requirements of concrete staves used in the construction of silos, grain tanks, coal pockets and other structures.

The following officers were elected for 1922: C. C. Woody, Madison Cement Stave Silo Co., Madison, Wis., president; W. B. Trost, Waterloo Playford Silo Co., Waterloo, Iowa, vice-president; W. G. Kaiser, Chicago, secretary-treasurer.

Agricultural Engineers Elect New President

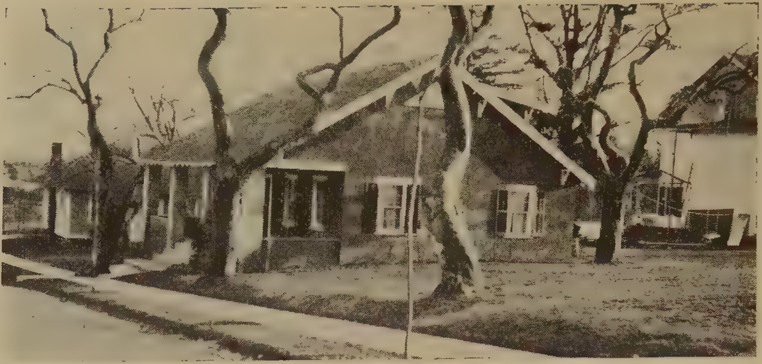
The American Society of Agricultural Engineers recently elected A. J. R. Curtis, of Chicago, Ill., as its president for the coming year. Mr. Curtis, who has given considerable time and thought to the growth and development of the society, is recognized as one of the best informed engineers in farm buildings in the organization.

Other officials who will assist Mr. Curtis with next year's work are G. W. McCuen, professor of Agricultural Engineering at Ohio State University, Columbus, Ohio, first vice-president; David Weeks, drainage engineer, Dakota Engineering Co., Mitchell, S. D., second vice-president; Frank P. Hanson, 1537 Conway Building, Chicago, former secretary of the society, treasurer; and George Iverson, advertising manager of the Advance Rumely Co., La Porte, Ind., councilman for three years. Raymond Olney, editor of *Power Farming Press*, St. Joseph, Mich., will act as secretary during the coming year.

Concrete Products Manufacturers will have two lively sessions at A. C. I. Convention, Cleveland.

Concrete Best for Suburban Homes

—L. C. Thompson



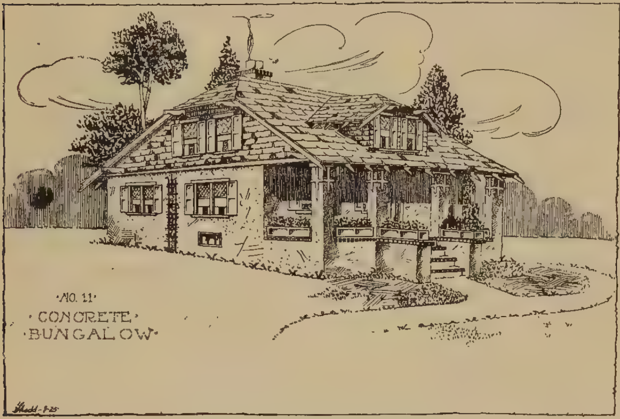


FIG. 2—L. C. THOMPSON PRODUCES HIS OWN PLANS—THIS IS BUNGALOW NO. 11—SEE NEXT PAGE

L. C. Thompson, carrying on the work of the Elm Terrace Realty Co., seems to have established the concrete house definitely as a factor in future house building in New Haven, Conn., and vicinity through his Elm Terrace suburban development, at Oyster River, near West Haven.

The illustrations show some of the first fourteen of what is planned as a 75-house enterprise.

The houses are built with concrete walls, wood frame floors and roof, by the Morrill system of steel forms. Mr. Thompson is doing his own planning and his own building, the construction operations being under the direction of A. E. Dunn, superintendent.

The forms, shallow pan-shaped units, are handled in tiers by the swing-up system, a tier at a time. This construction has been described in CONCRETE several times in connection with other work by the Morrill system.

Concrete is of cement, sand and cinders—1:2:3½; stucco finish outside; inside lath and plaster on furring strips, which are nailed into the cinder concrete walls, while green.

One man operates the mixer, two men wheel concrete over runways on staging, and two men work "on top." Mr. Dunn, with such a crew, builds a concrete shell complete in six working days, the superintendent himself taking the responsibility of leveling up frames and overseeing the details.

The development was started with two frame houses, and after less than two years the comparison speaks volumes.

Mr. Thompson is also developing a golf course and club house on his property, and the houses he has completed will not be offered for sale (most of them are now occupied on a rental basis) until the club is turned over complete to its members.

The houses are very remarkable for ingenious planning. They are of the low, broad, cottage, or semi-

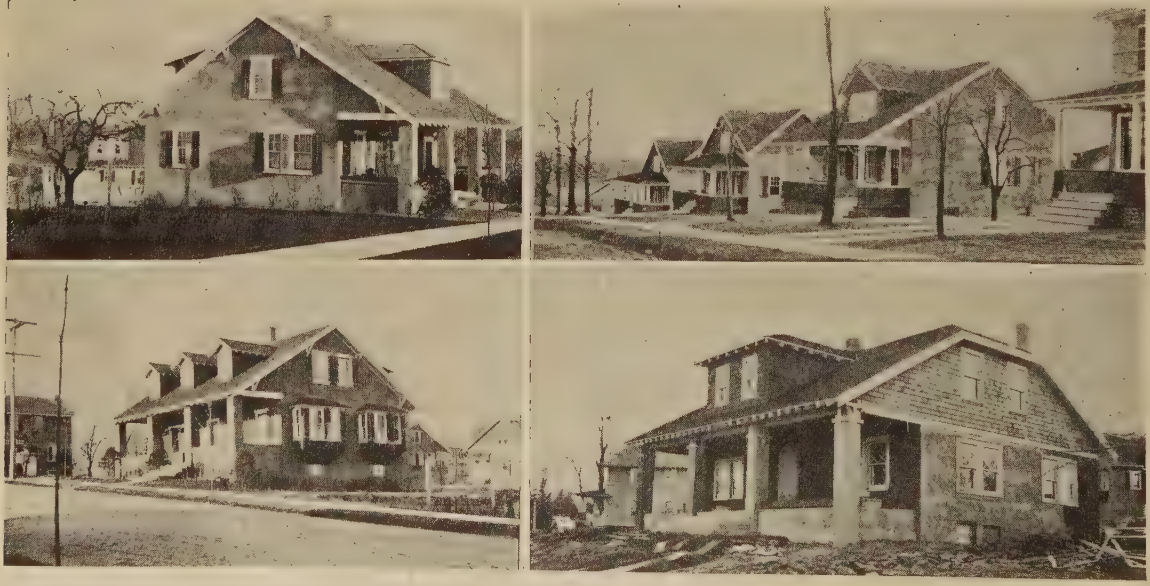


FIG. 3—SOME OF THE CONCRETE WALL HOUSES BUILT BY L. C. THOMPSON

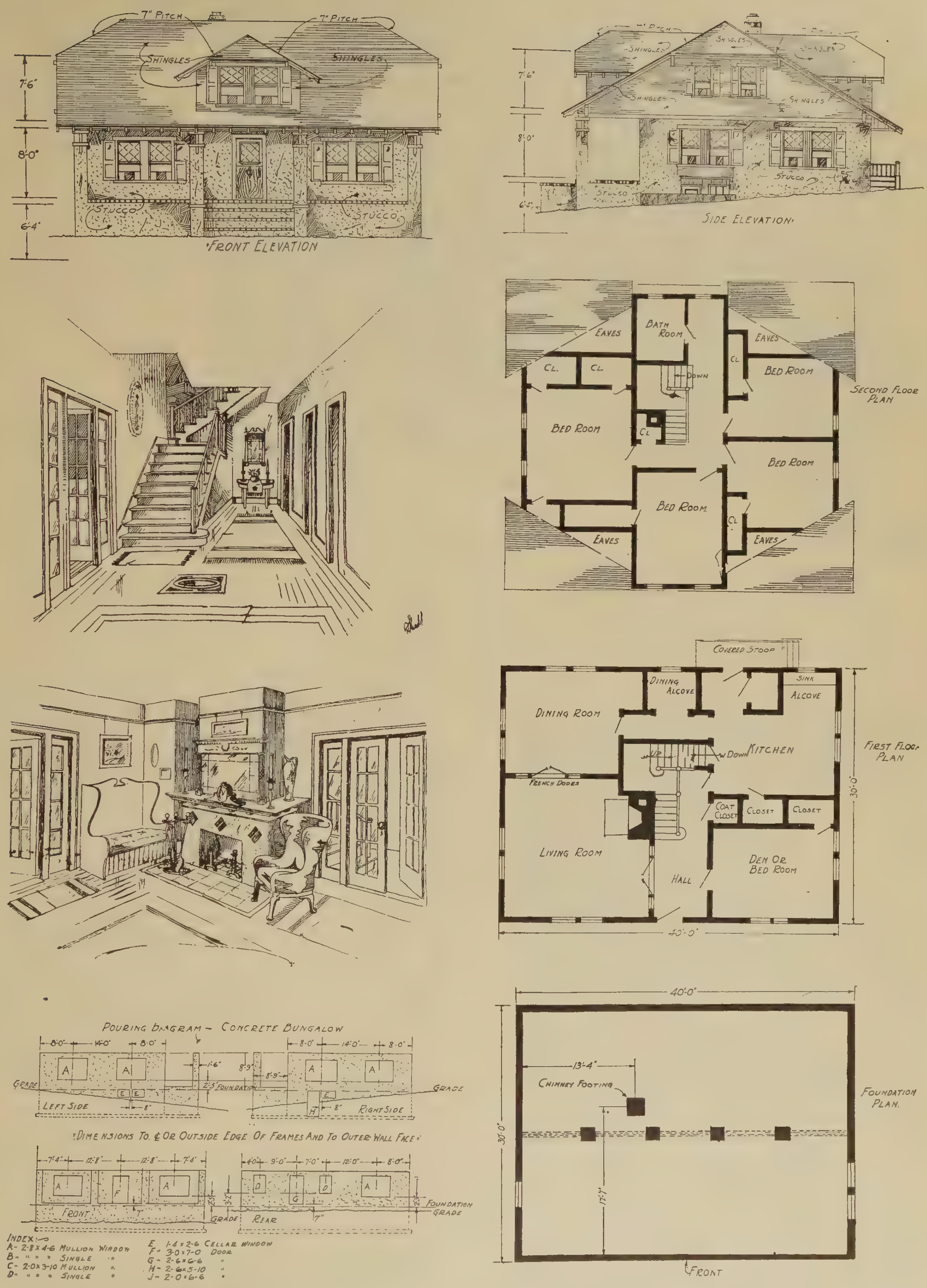


Fig. 4—These Drawings Show Mr. Thompson's Bungalow No. 11

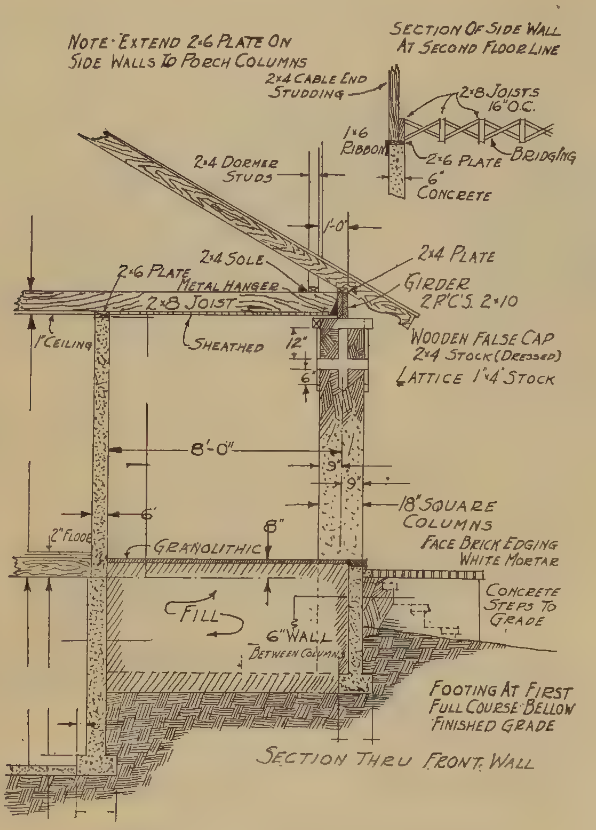
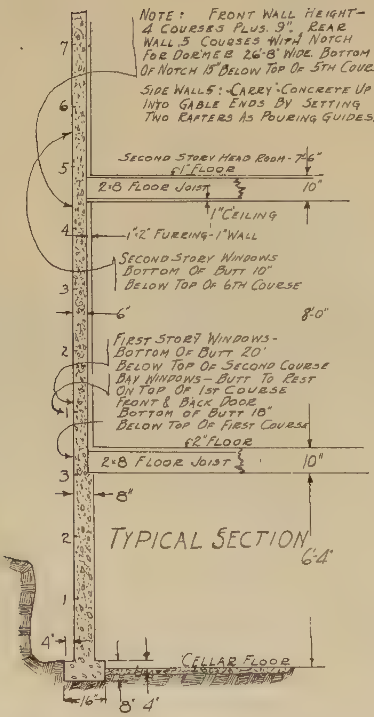


Fig. 5—Details of L. C. Thompson Bungalow No. 11

bungalow type, but are very deceptive as to roominess. They have that desirable attribute of smallness, coziness and close-to-the-groundness, and one of them, occupied by Mr. Thompson, looks from the outside to have probably seven rooms—as a matter of fact it has 10 rooms (5 bedrooms) and two baths—all the rooms of better than average size.



Note: Front Wall Height—4 Courses Plus 9". Rear Wall 5 Courses With Notch For Dormer 26'-8" Wide. Bottom Of Notch 15" Below Top Of 5th Course
Side Walls: Carry Concrete Up Into Gable Ends By Setting Two Rafters As Pouring Guides.
7
6
5
4
3
2
1
3
2
1
Second Story Head Room - 7'-6"
1" Floor
2×8 Floor Joist
10"
1" Ceiling
1"×2" Furring - 1" Wall
Second Story Windows Bottom Of Butt 10" Below Top Of 6th Course
6"
8'-0"
First Story Windows - Bottom Of Butt 20" Below Top Of Second Course
Bay Windows - Butt To Rest On Top Of 1st Course
Front & Back Door Bottom Of Butt 18" Below Top Of First Course
2" Floor
2×8 Floor Joist
10"
8"
Typical Section
6'-4"
4"
Cellar Floor
16"
8'-4"

Fig. 6—Such a Drawing on the Job Avoids Errors

Mr. Thompson has not approached concrete house building for its cheapness on a basis of frame construction, but as the most economical material with which to erect *good masonry houses*. The construction is not skimped. The details are watched closely, and good tight results are obtained. Fuel costs are low—the houses are of a character to win the approval of life insurance investors for liberal loans.

He has been immensely pleased with results, and would scarcely consider any other material on future work.

Mr. Thompson has contracts to erect 27 concrete houses for other owners in early spring, and he is considering very seriously taking some steps to expand his operations to meet the demand for concrete houses in other localities, in view of the fact that few contractors are trained or equipped to take concrete house jobs on an economical basis.

New England Colonial Farm House of Concrete

One of the most unusual achievements of concrete house building in the last year is on Common street, Belmont, Mass., the work of V. H. Wigglesworth, architect.

It is of reinforced concrete throughout—walls (which are double), floors, stairs, and roof—even to the tile, which are monolithic with the roof slab. Yet the casual observer would never suspect it to be anything else than a particularly well preserved example of the New England colonial farm house, with wide, heavy drop siding and beautiful two-story front columns. Even the hooded doorway with its moldings are of concrete, monolithic with the structure as a whole.

While this seems to be flying in the face of a common architectural conception that a structure should express the material of which it is made—Mr. Wigglesworth stoutly maintains that the lines of the old farm houses are so good for their own sakes—drop siding and all—that they deserve preservation in a permanent and worthy material. The forms for walls proper were carefully made for horizonal courses about 2 ft. high and were used repeatedly with very little waste. They are so faced as to produce the drop siding effect.

Surfaces were carefully pointed, filled with a cement wash and rubbed with fine carborundum. The walls were then given a finish of special white paint.

The Semi-Annual Index to CONCRETE, Vol. 19, July to December, 1921, will be ready for distribution to those who want it, about Feb. 1.

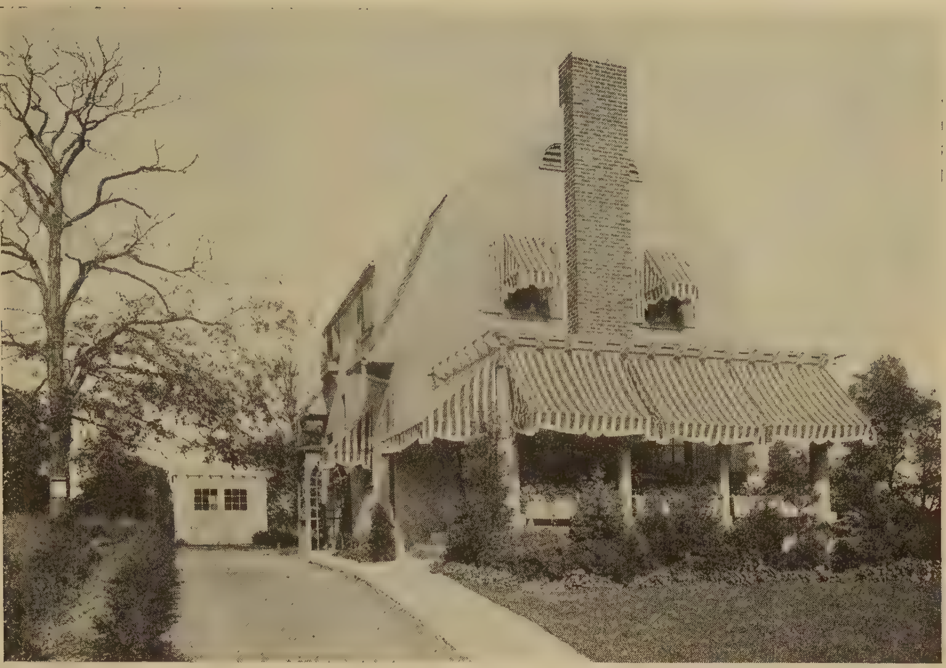


Fig. 1—A Hueber Brothers Reinforced Concrete House — Walls and Floors Fireproof

Hueber Brothers' Aim Isn't Cheap Houses

The work of Hueber Brothers, builders, in Syracuse, N. Y., in erecting concrete residences with their own system of forms, to meet an increasing demand for fireproof homes of attractive architecture, was described in detail in this magazine in January, 1921.

Additional houses have been built this year, the Hueber system being modified and simplified from time to time as the work progressed, and the results encourage the builders to believe that they are getting minimum costs as compared with any equally good construction.

The builders have not attempted to put up cheap houses. They have had for their aim the construction of the concrete shell—including reinforced concrete walls and floors at a lower cost than can be obtained with any other type of construction. This done, the finish and equipment have been of the best. For those readers not familiar with the Hueber system an isometric sketch from the January, 1921, issue of Concrete is republished. Of the developments of the last year, Hueber Brothers write:

Our average schedule for the last three houses, size 25 ft. by 31 ft., with a crew of one carpenter and five laborers, was:

1. Erecting forms, six men, four eight-hour days.
2. Pouring, placing reinforcing and sleeves and erecting scaffold, six men, three eight-hour days.
3. Stripping and cleaning forms, six men, two eight-hour days.

We are confident this schedule could readily be followed by practically any crew.

The forms continue to show practically no signs of wear, despite continued use during this year. They have required no repairs so far, and we are convinced of their durability.

We have done away with the outside sill course and are now experimenting with eliminating all outside studs, constructing the outside panels in such a way that they take all the load without studs to support them. We have also worked out a system of scaffolding which is part of the forms and built into them. While we recognize the merits of the Insley equipment for pouring several houses with the one set-up, we have worked out and will put into actual use in the spring a cart system of pouring, which will work in as part of the forms and will be more economical and desirable for single house jobs in different locations.

We are now studying the possibilities of using cork board applied direct to the inside of all exterior reinforced concrete walls as an insulator and plastering surface, instead of the usual furring and lathing method. We are also going to use

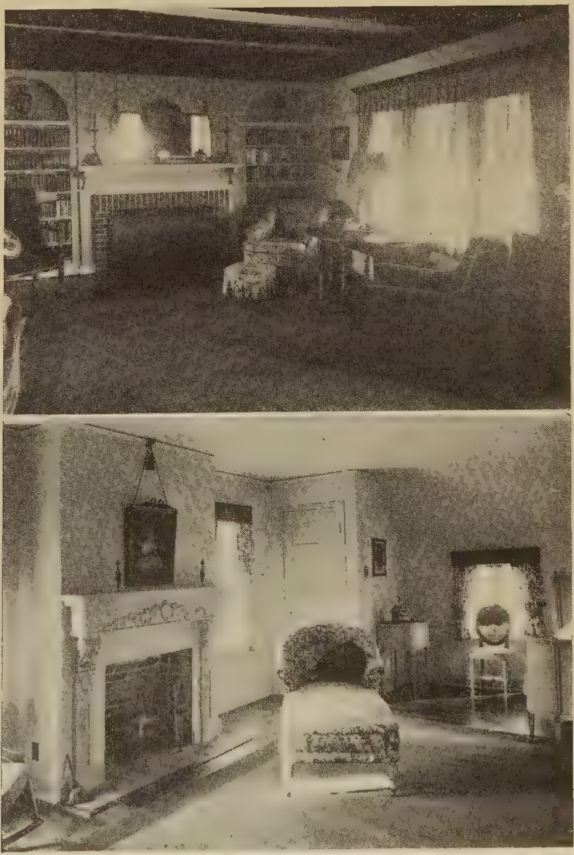


Fig. 2—Hueber House Living Rooms

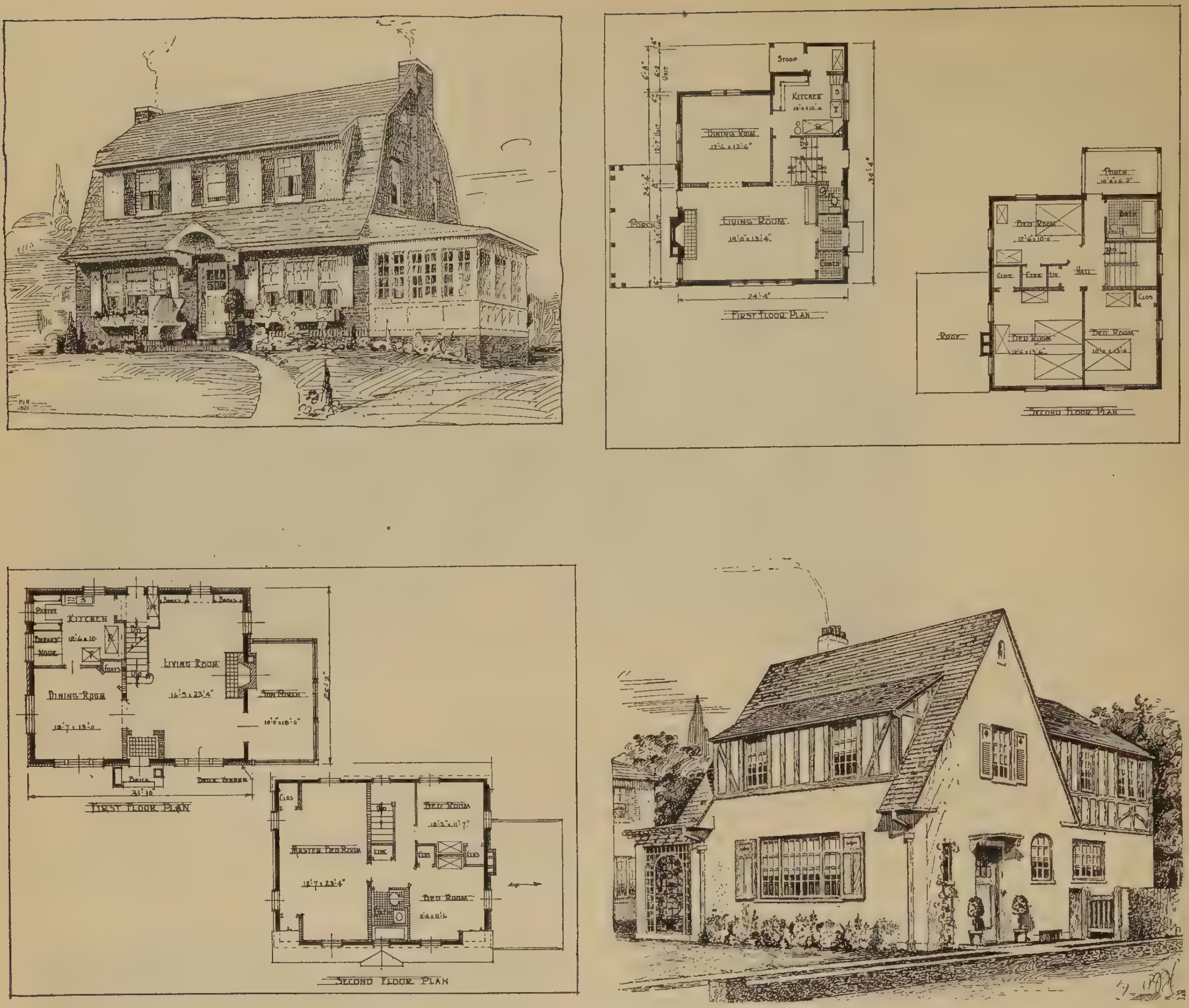
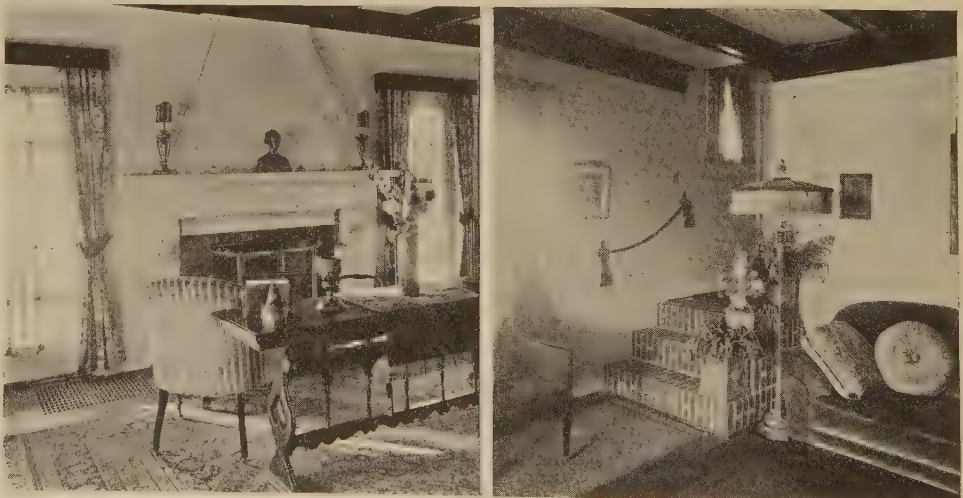


Fig. 6—Hueber Brothers, Having an Able Architect as One of Their Number, Produce Their Own Plans for Their Own Operations—Some of the Houses Are Designed to Be Faced with Brick Rather Than Stucco

Fig. 7—Interior Finish in Hueber Houses Is of the Best—They Are Producing GOOD Houses, not Cheap Ones—Incidentally, Hueber Houses Are Cheap When Compared with Other Well Built Homes



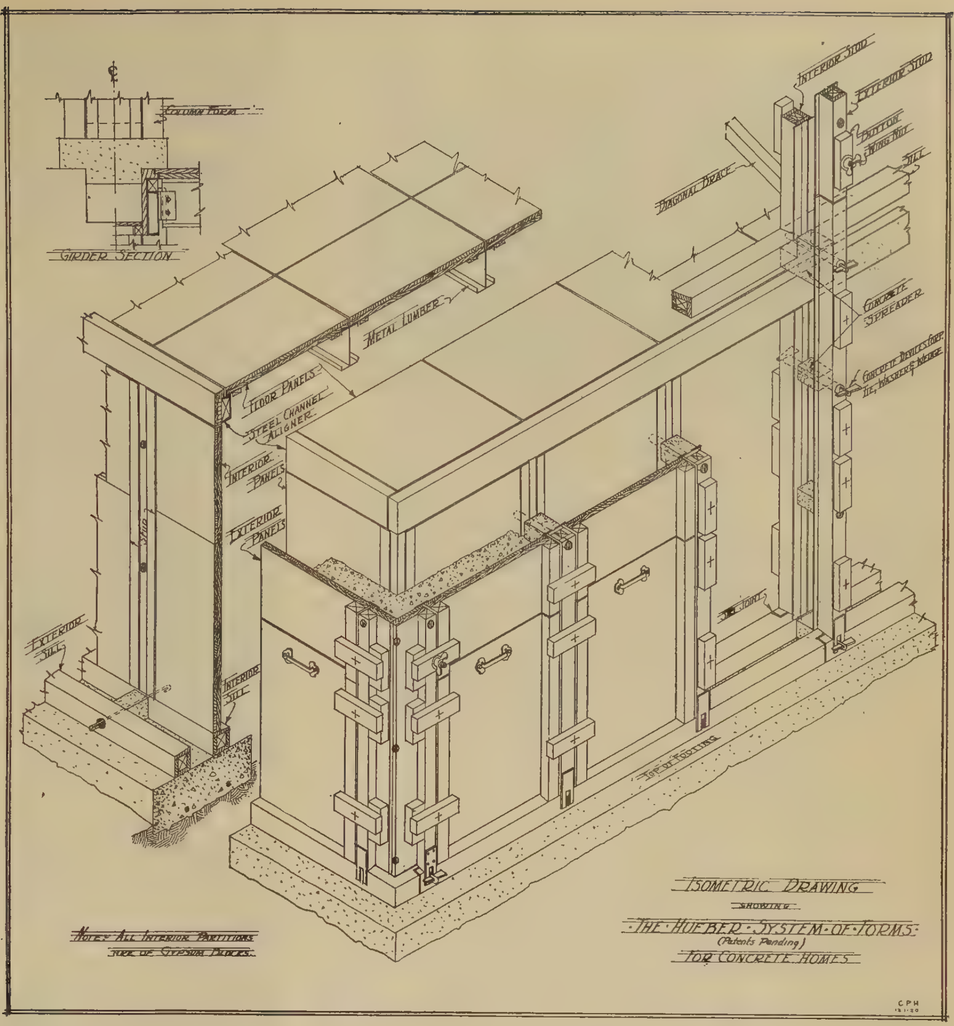


FIG. 3—LIGHT, BUILT-UP POSTS OR STUDS REST ON SILLS ON THE FOOTING, AND SUPPORT TWO-PLY PANELS THAT ARE BUTTONED INTO PLACE—PRECAST CONCRETE SPACER BLOCKS, WITH HOLES FROM END TO END, RECEIVE TIE RODS, HELD BY KEYS—PRESSED STEEL CHANNELS ARE USED FOR LINERS AND PRESSED STEEL I-BEAMS SUPPORT FLOOR FORM PANELS

gypsum dome tile floor construction, which of course does away with considerable dead weight and makes a warmer second floor ceiling.

While we recognize fully the importance of an economical first cost construction proposition, we like to have people think of the Hueber system in another light. After all is said and done, if a system gets up the concrete part of a house at a minimum first cost as compared with any other type of construction, that is all that can reasonably be expected and required. Thereafter, what goes in to make up the plumbing, heating, electrical equipment, roof, porch and decorating must naturally rest with and be almost absolutely dependent upon what the contractor, builder, architect, or owner wants to spend. We cannot say too strenuously how unfair we feel is the literature one generally finds on concrete home construction. Our contention is that a $1,000 plumbing layout costs just as much when put into a concrete home as in any other construction. In other words, get a reasonably low first cost concrete shell construction, permitting of variations in exterior and interior designs, that will answer architects, builders, etc., and then let them put in as much or as little into the rest of the job as they want to and pay accordingly.

Several interesting Concrete House Construction Operations will be described in February issue of CONCRETE, owing to lack of space this month.

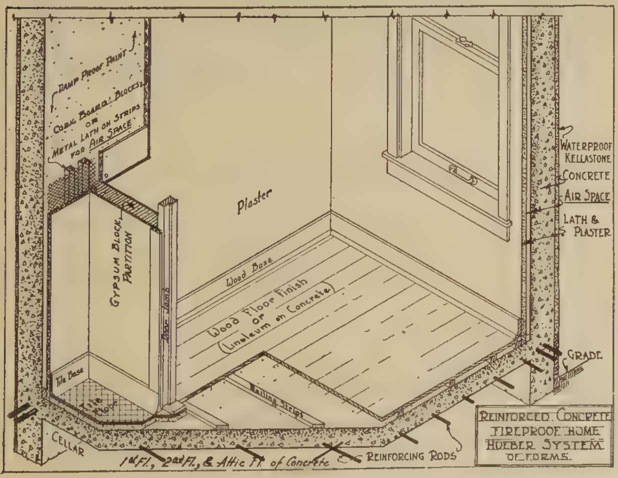

DAMP PROOF PAINT
CORK BOARD BLOCKS OR METAL LATH ON STRIPS FOR AIR SPACE
GYPSUM BLOCK PARTITION
Plaster
Wood Base
Door Jamb
Wood Floor Finish or (Linoleum on Concrete)
Tile Base
Tile Floor
Nailing Strips
WATERPROOF KELLASTONE
CONCRETE
AIR SPACE
LATH & PLASTER
GRADE
CELLAR
1st Fl., 2nd Fl., & Attic Fl. of Concrete
REINFORCING RODS
REINFORCED CONCRETE FIREPROOF HOME HUEBER SYSTEM OF FORMS

FIG. 4—ISOMETRIC VIEW OF HUEBER CONSTRUCTION

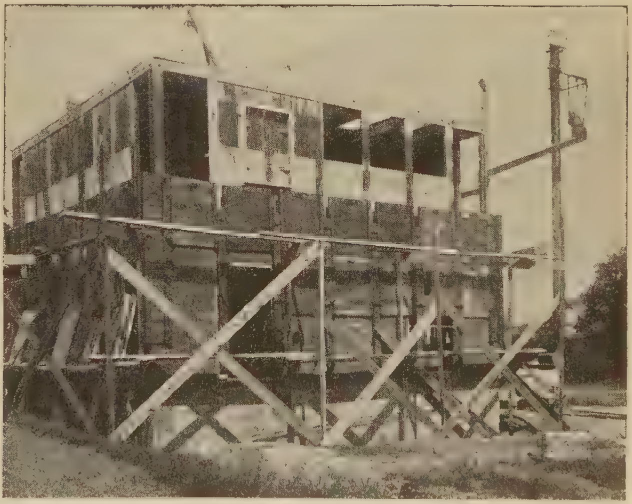


FIG. 5—HUEBER HOUSES UNDER CONSTRUCTION

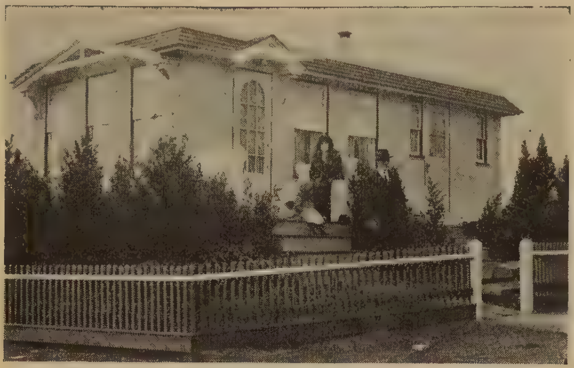


Fig. 1—First Simon Lake House on Exhibition in Bridgeport, Conn.

Factory Built Houses Moved by Truck

In the shipyard near Bridgeport where he built submarines, Simon Lake is experimenting with concrete houses. These are made of the lightest possible section, and when complete they are loaded on to a cradle and hauled by truck to the purchaser. Three such houses have been built, and the methods are not yet standardized.

Fig. 1 shows the first house, hauled into Bridgeport for exhibition purposes and since hauled back again to the yard.

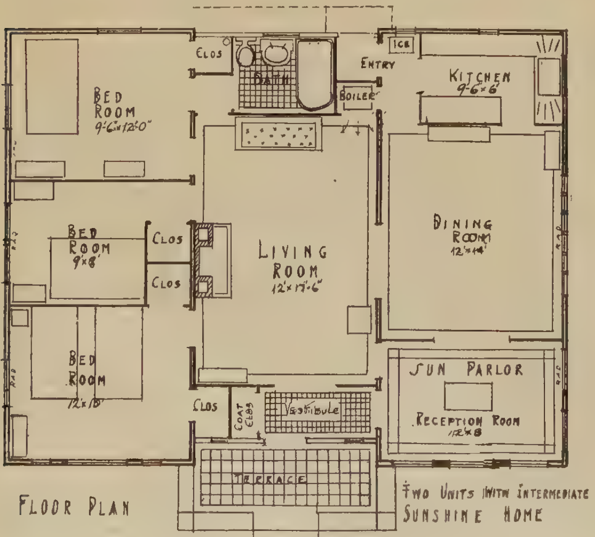
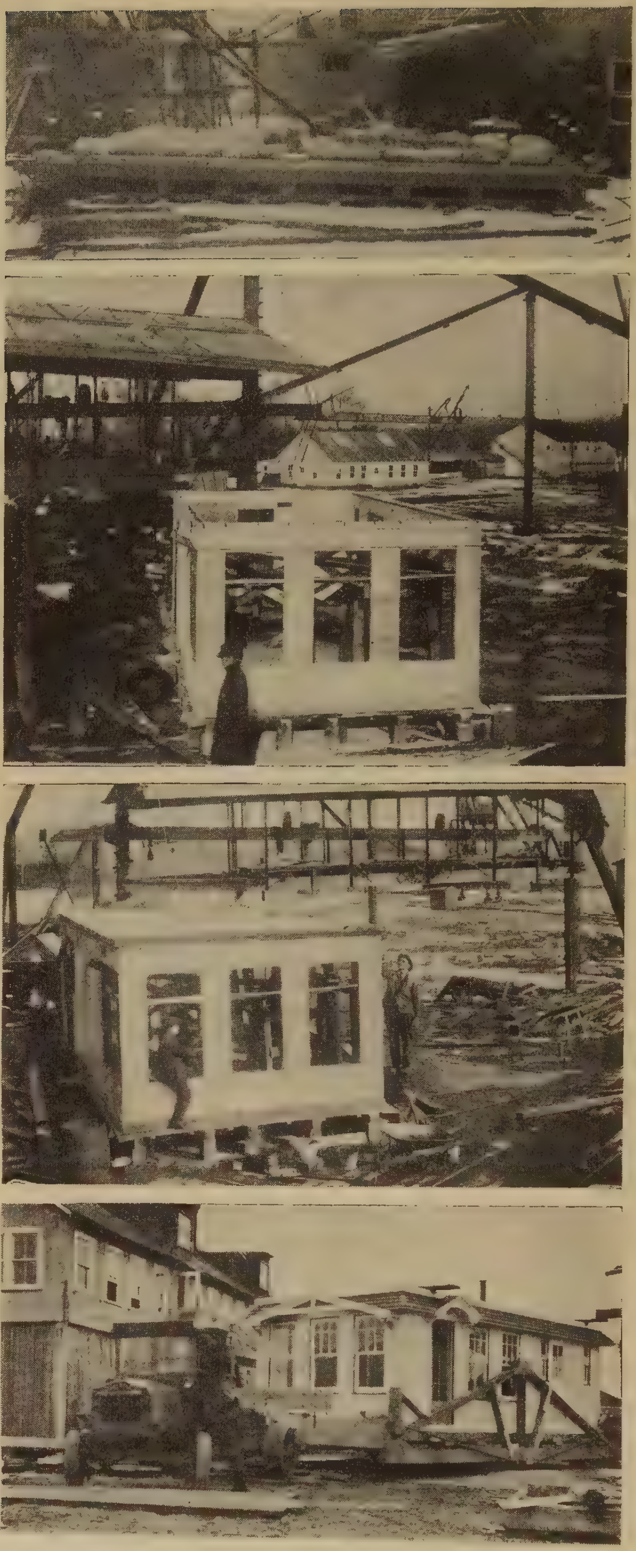


Fig. 6—Two or More of the Simon Lake Units Joined to Make a Bungalow



Figs. 2-5—Manufacturing Simon Lake Houses

This is a single unit, and is 12 ft. 6 in. by 27 ft. in plan. The floor is a hollow slab, and the side walls are also hollow, but walls and floor are cast together, forming a monolithic structure. The roof, also hollow, was separately cast, and when cured was superimposed on the walls. The inner web of the exterior double walls is ⅜ in. thick, and the outer web ⅝ in. thick. A 2½-in. air space separates these two slabs. The two sides are spaced by creosoted strips of wood and tied together, so that the concrete of the outer wall does not come in contact with the inner wall at any place. The inner surfaces are enameled with a bitumastic enamel applied when the structure is hot, so that the enamel enters the pores of the concrete and makes the structure water-tight and damp-proof. The thin cores are given a bituminous coating and after steam heat is applied the cores are withdrawn, leaving the bituminous film behind.

The first house was poured, using a 1:3 mix of material passing a ¼-in. screen. A later house was concreted over the cores on a metal mesh, using a Hodges stucco machine.

The roof, 12 ft. 8 in. wide and 27 ft. 3 in. long, has a bottom slab ⅜ in. thick, which forms the ceiling, and an upper slab ⅝ in. thick which forms the roof portion. An air space of 2½ in. separates the slabs. A test load of 10,000 lbs. of sand in bags (Fig. 2) was placed on this roof slab, supported on two sides. The slab was designed for a snow load of 30 lbs. per sq. ft., and it deflected $\frac{1}{8}$ in. under dead load and $\frac{1}{2}$ in. at the center under live load. In addition, three men got on the center of load and by jumping up and down caused the slab to vibrate without damage to it.

Fig. 3 shows the roof slab being lifted into place. Fig. 4 shows the roof slab placed and the lifting derrick swinging to one side. Fig. 5 shows the method of transporting the finished unit. The estimated weight is about 15 tons, and a special ten-wheel truck was designed to transport it. Simon Lake is still going ahead with the development of this type of construction, but he is refraining from making details public until his methods are standardized. The development is being promoted by the Sunshine Homes Corp., New York City. A single house unit offers possibilities as a seashore camp. Two or more units joined suggest larger usefulness (Fig. 6).

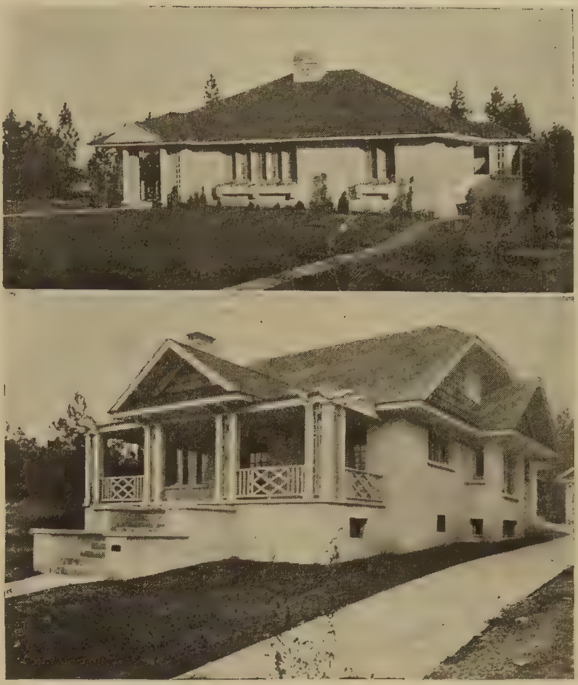
Double Wall Bungalows in Spokane

The Concrete Construction Co. is building attractive Van Guilder system double wall houses in Spokane, Wash.—two of them shown from photographs and plan drawings.

M. R. Smith, vice-president of the construction company writes:

The concrete house is taking hold here in one of the great centers of the lumber industry, where lumber is cheaper and cement is somewhat higher than in the East.

Though we have this price handicap to contend with, we have found that by using double walls for foundation and outer walls, and using frame partitions, floor and roof construction, the cost runs about 5% above the frame house. The Van Guilder system, having the continuous dead air space, enables us to plaster directly upon the concrete on the inside with no danger of the decorations being damaged by condensation of moisture, and there is absolutely no chance of water coming through the wall. The insulating quality of these walls has been given a good test here this year, as we had a cold period last month (November)—colder than the coldest weather of most of our winters—and the owners of these homes found them much easier to heat than the ordinary frame house. We expect them to show a fuel saving of at least 30% compared with frame construction.

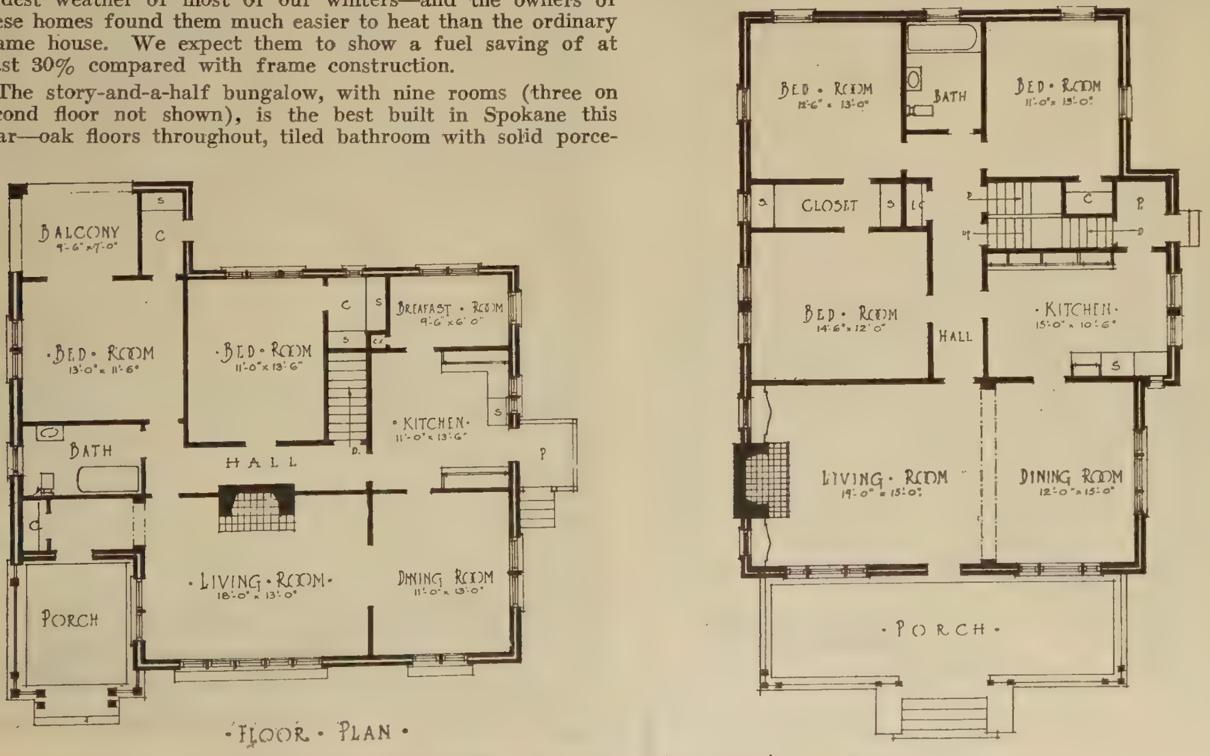


Double Wall Bungalows by Van Guilder System, Built by Concrete Construction Co., Spokane, Wash.

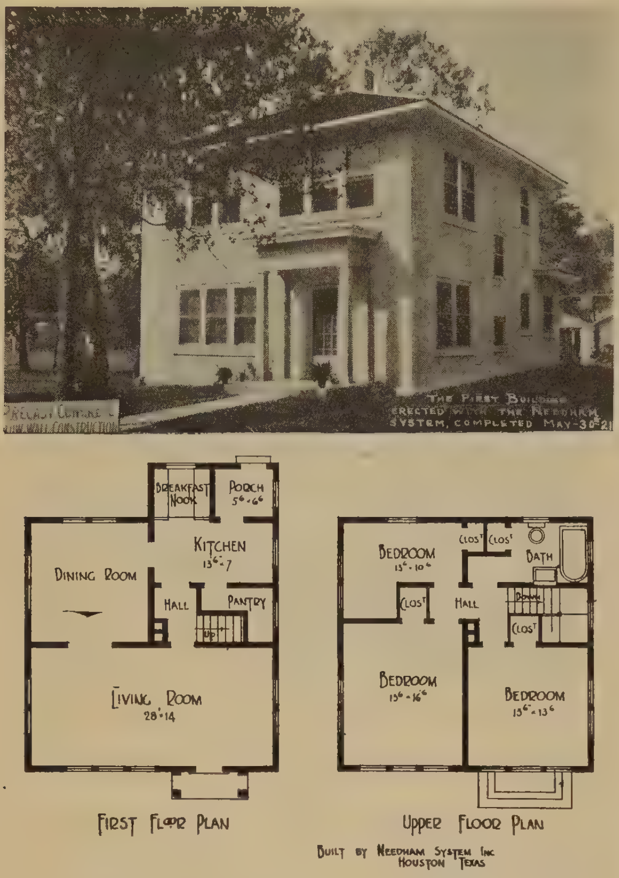
The story-and-a-half bungalow, with nine rooms (three on second floor not shown), is the best built in Spokane this year—oak floors throughout, tiled bathroom with solid porcelain plumbing, beautiful built-in features, electric kitchen and laundry. The basement is subdivided with concrete partitions, which form the bearing walls, and the porch floors are reinforced concrete slabs.

The smaller bungalow has answered this question often asked, "Does not a concrete house look cold and uninviting?" The walls are a light cream, done in sand dash with Atlas white cement. The trim is a shade darker than the stucco, and the roof is stained brick red. The flower boxes are of waterproofed concrete cast in place.

We have recently built by the same system a concrete automobile service station at Dishman, Wash., just east of Spokane. This is strictly modern, full cemented basement, hot water heat, electric water heater, large sales room, ladies' rest room, and men's room, lavatories and drinking fountain.



Plans of Bungalows Illustrated Above—Morrison & Stimson, Spokane, Architects



Figs. 1 and 2—First House Built by Needham System of Precast Units—Completed May 30, 1921

Needham System Employs Precast Units

The Needham system, developed in Houston, Texas, and used first in the construction of the house illustrated, utilizes precast units tied together in the footing and at floor levels by belts of concrete cast in place. It has features very similar to the Moore system, previously described in Concrete[1] in connection with housing work by the Turner Construction Co., for the Humble Oil Co.

Fig. 3 shows the units as erected. The footing is grooved to receive channel shaped wall units, whose cross webs are cut out to connect the air ducts formed by the channels. Adjacent wall unit flanges curve at the top to form keyways, while the flanges of the opposing wall units (forming the other side of the wall) fit closely against the flaring sides of the keyways, so that when a beam is cast in place only the keyways or pockets are filled and not the hollow spaces below them. Projecting reinforcing in the wall units projects into the beam when cast in place. Joists are held temporarily with ends forming their own pockets in the beam. Fig. 4 shows an apartment under construction. Actual erection is reported to have started on the job 12 days previous to the making of the picture.

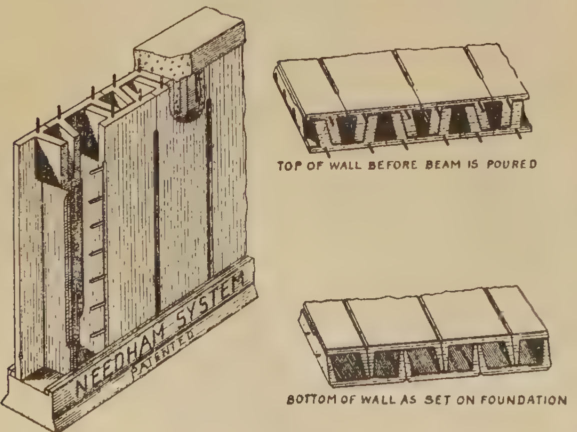

TOP OF WALL BEFORE BEAM IS POURED
BOTTOM OF WALL AS SET ON FOUNDATION
NEEDHAM SYSTEM
PATENTED

Fig. 3

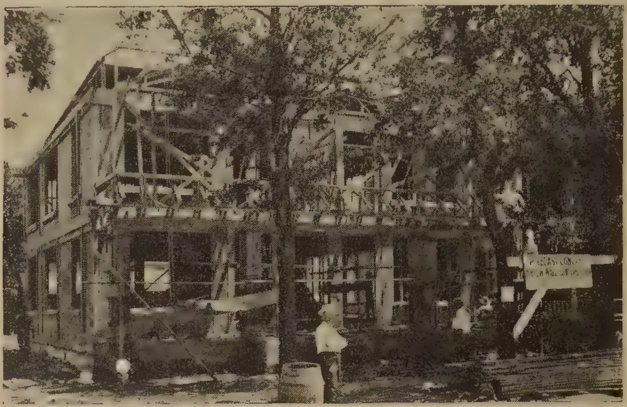


Fig. 4—Progress with Needham System on Mulcahy Apartments, Houston, April 20 to May 2, 1921

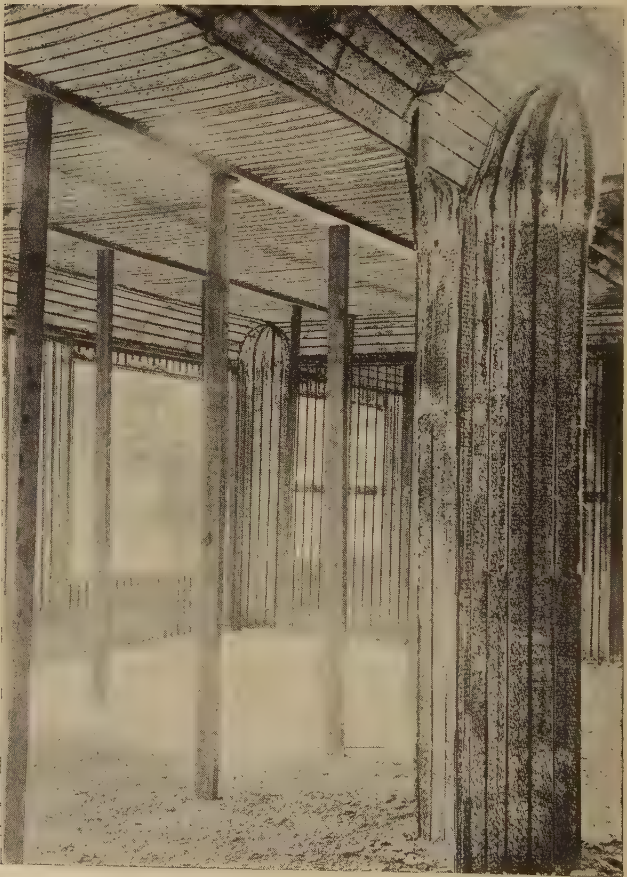


Fig. 5—Column Beam and Slab Structure Before Plastering

See Opposite Page—Donaldson System

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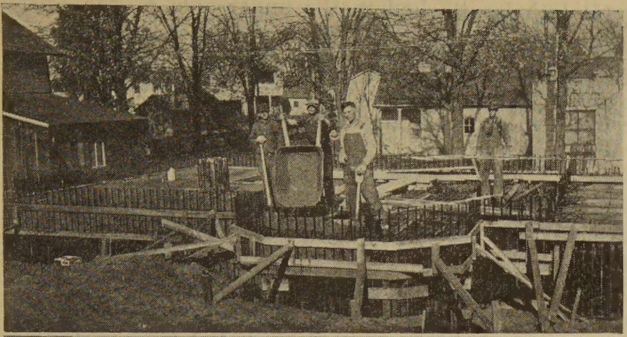
[1] Concrete, June, 1920, page 249.



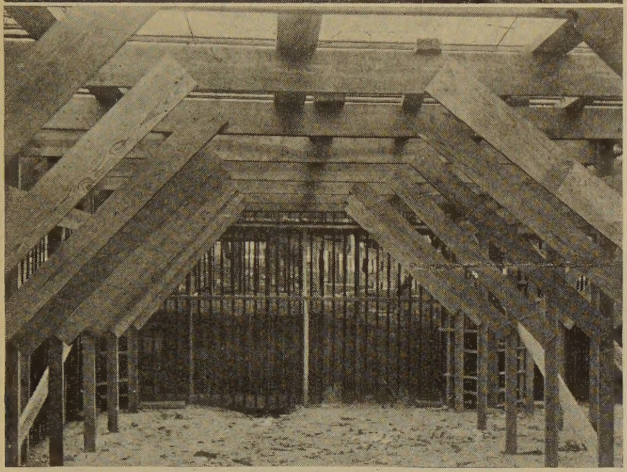


Fig. 1—Lath in Place for Foundation Walls and First Floor

Fig. 2—Shoring Supporting Floor Lath

Metal Lath for Forms and Reinforcing

The feature of the Donaldson system of construction is the use of expanded metal lath for forms, for reinforcement, and as a base for plaster and stucco.. The walls are hollow, plastered on the lath, and the load is carried by reinforced concrete columns and beams formed and reinforced with lath, and by additional rods where indicated by the design. The floor and roof slabs are on expanded metal, as a centering and reinforcement supported by temporary shoring.

Progress photographs are reproduced in Figs. 1 to 7; finished houses in Fig. 8.

The system has been used in several different parts of the country, and C. W. Donaldson, the inventor, claims for it the means of building reinforced concrete houses cheaper than frame. The concrete is used wet, and the job progresses a story at a time. The variety of individual problems in placing the expanded metal requires careful supervision.

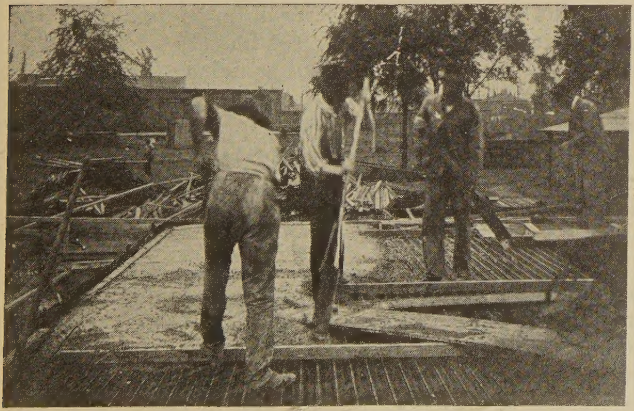


Fig. 3—Placing a Floor Slab

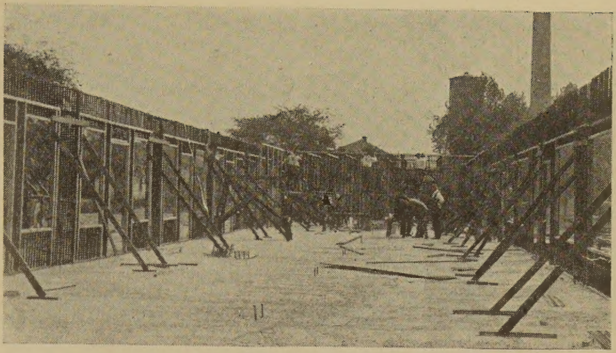


Fig. 4—First Floor Poured, Second Floor Shoring Being Erected

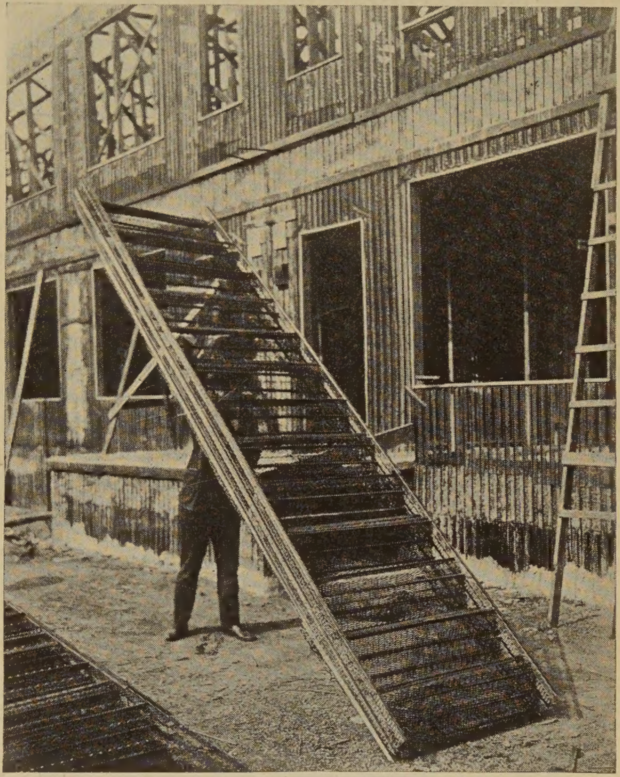


Fig. 6—Stairway Fabricated—Building Poured to and Including Second Floor Slab

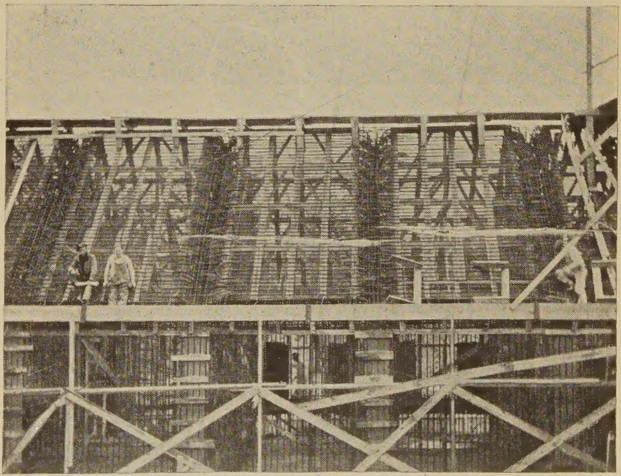


Fig. 7—Working on a Church Roof

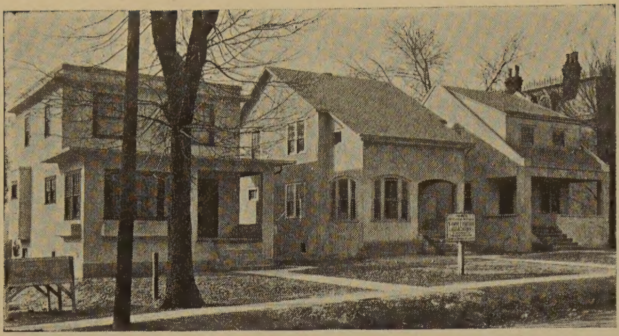


Fig. 8—Completed Donaldson System Houses

Standardized Metal Lumber Houses

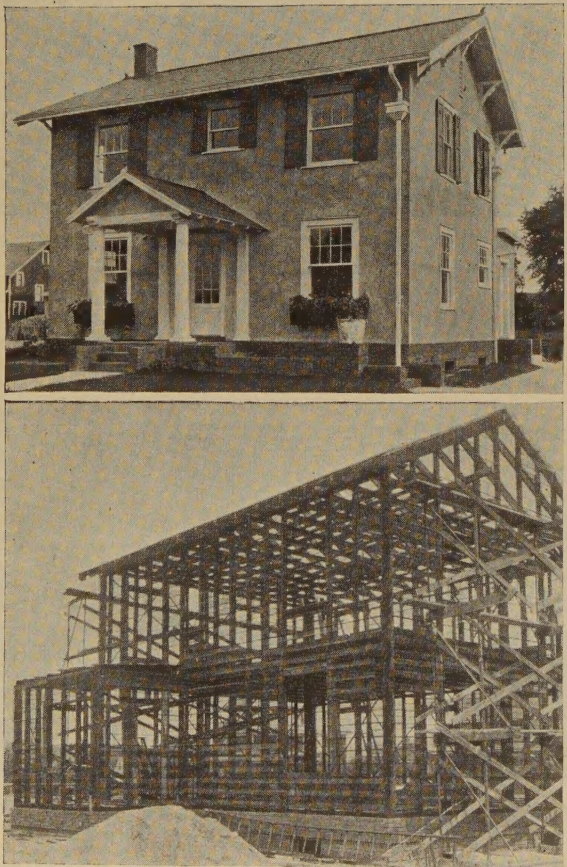
The pictures show one of a series of standardized metal lumber and stucco houses—complete and under construction. It was erected at Canton, Ohio, by Berger Manufacturing Co., engineers, to demonstrate the new system of standardized metal frame produced by that company.

The framing of the outer walls is of 4-in. channel shapes, on the inner and outer flanges of which prongs are punched out for the easy and firm attachment of metal lath. The partitions are of 2 or 4-in. studs on both sides of which expanded metal lath is attached. The floors are framed with metal lumber joists spaced 2 ft. apart. Wood nailing strips are nailed to the joists. Metal lath is attached to the under side of the joists.

The roof is supported on metal lumber rafters, to which nailing strips are attached in the same way as on the floors. Wood sheathing and any form of roofing desired can then be applied.

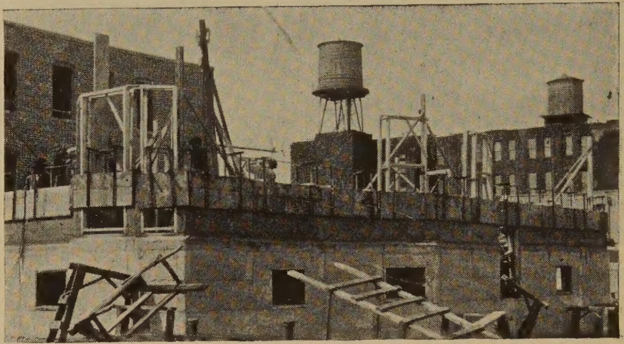
Wood grounds are applied for the attachment of windows and door frames, and for all trimmings such as base-boards, picture molding, etc. In the finished house no metal will show; all is covered by stucco, plaster, and trimmings.

Such a frame work might provide a means of further development of the improved back-plastered stucco.



First of a Series of Standardized Metal Lumber and Stucco Houses

Frost System Double Wall Houses



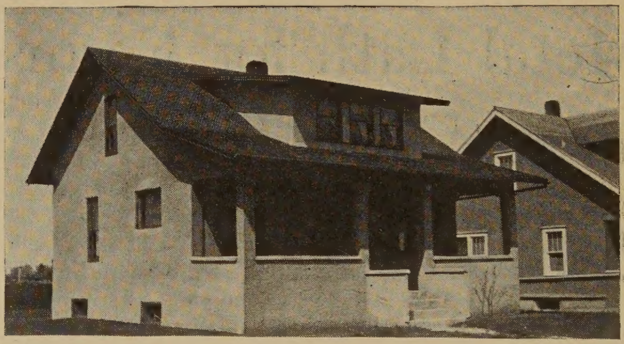


Fig. 2—Frost System in Use on Jersey City Two-Family House

Fig. 3—Mitchell South Dakota House Built by Frost System

The Frost system of hollow wall construction, developed by the Hollow Concrete Wall Co., Mitchell, S. D., has been used in building houses at Michell, cottages for the Nebraska Cement Co., Superior, Neb., and a two-family house, one of several to be built for the Eagle Works Building Assn. (employees of the Eagle works of the Standard Oil Co.), at Jersey City, N. J.

The forms are of plank, 18 in. high, in sections, 4, 6, and 8 ft. long, bolted to a T and angle iron frame, and having a sheet metal core to form a 2-in. air space. Forms are shown spread and core collapsed and raised at the left, and tightened ready for pouring at the right, in Fig. 1.

Fig. 2 shows progress to two courses above the foundation on the first of the Eagle works houses. This job has been done on a co-operative basis by oil company employees working turn-about on off days. It has not, however, been an economical operation from a labor standpoint, due to interruptions and to the necessity of breaking in new men almost constantly. Concrete was placed from a tower through chutes. Progress has been at the rate of one 18-in. course per day.

The accompanying comparative figures are furnished as representing the estimates of the Nebraska Cement Co., which expressed entire satisfaction with its use of the system in the erection of employees' cottages.

The two 3-in. walls normally used with the Frost system are tied together through a 2-in. air space by galvanized ties. Stucco is applied outside and plaster direct inside. The walls may be of 4-in. or 6-in. thickness each, instead of 3 in.

Comparison Sheet

(Nebraska Cement Co. Figures)

100 sq. ft. finished wall, 3 x 3 in., with 2-in. air space, requires:	
2 yds. sand and gravel, at $1.50 per yd	$3.00
10 sacks cement, at 75c per sack	7.50
Wall ties and reinforcing	2.00
11 1/9 yds. outside finish	5.50
11 1/9 yds. inside finish	3.00
Labor to construct walls	6.50
	$27.50
Contractor's profit, 10% of $27.50	2.75
	$30.25
100 sq. ft. finished wall of wood requires:	
10 pcs. 2 x 4, or 70 ft., at $40.00 per M	$2.80
120 ft. sheeting, at $40.00 per M	4.80
123 ft. siding, at $55.00 per M	6.76
105 ft. building papers	.40
Nails	.50
100 ft. flax lining	5.50
Paint and painting	8.00
11 1/9 yds. lath and plastering, 70c per yd	7.22
Carpenter work	9.50
	$45.48
Contractor's profit, 10% of $45.48	4.54
	$50.02
100 sq. ft. finished wall cement blocks, 8 x 8 x 16 in., requires:	
112 blocks, 20c each	$22.40
Mortar in which to lay them, at 4c each	4.48
Labor to lay them, at 6c each	6.84
11 1/9 yds. furring lath and plastering, at 75c per yd	8.33
	$42.05
Contractor's profit 10% of $42.05	4.20
	$46.25

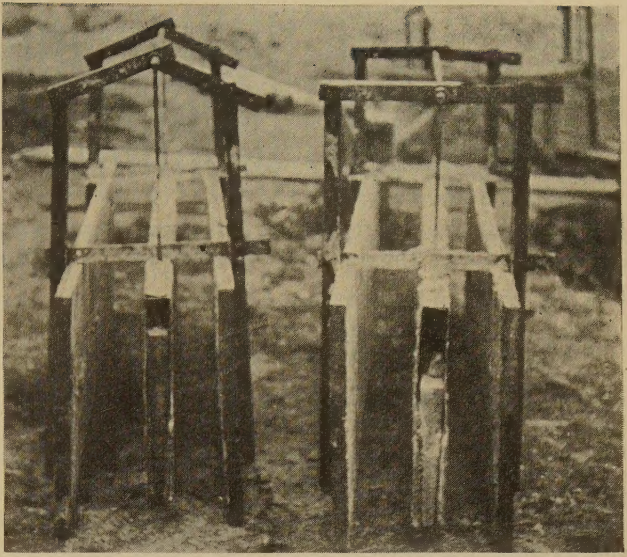


Fig. 1—Frost System Forms—Tightened and Collapsed by Movement of Toggles

Houses Built of Dodson Boards

Dodson concrete boards, of which several houses and other buildings have already been erected, are an outgrowth of the concrete silo stave. Dodson boards are in reality staves 10 in. wide, 3 in. thick and in lengths of 7, 14 and 28 in. They are tongued and grooved on their edges, to be laid up without mortar, and slatted on their surfaces to receive steel rods, extending throughout the length of any given panel, threaded on the ends so as to draw the units up tight. The rods are first dipped in cement grout, and the slats are filled by the first mortar coat of stucco with which the wall surfaces are finished. Pilasters, poured in place, tie and stiffen the thin unit curtain walls. The walls are furred inside for application of lath and plaster.

The Dodson Cement Products Co., Wichita, Kans., reports that one skilled workman at $8.00 a day and two laborers at $4.00 a day, working eight hours a day for three days, set up complete the concrete shell of a five-room Dodson bungalow. The house was entirely completed for occupancy in five weeks.

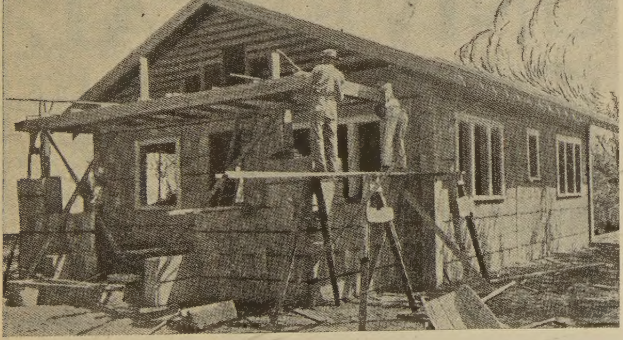


Fig. 1—Dodson Concrete Board House Under Construction

The Semi-Annual Index to Concrete, Vol. 19, July to December, 1921, will be ready about February 1 for distribution to those subscribers who ask for it.

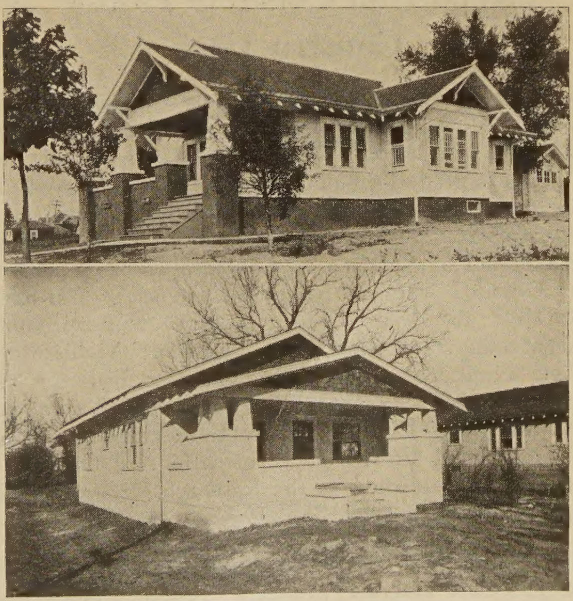


Fig. 2—Dodson Houses in Wichita, Kans.

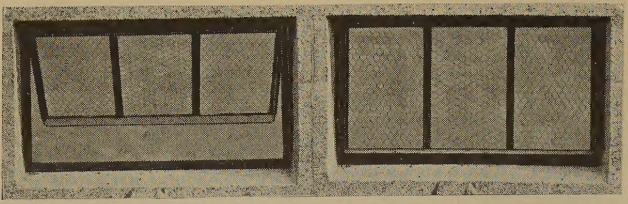


FIG. 1—OUTSIDE VIEW OF TWO WINDOWS FITTED WITH STEEL FRAMES AND SASH, SHOWING ONE WINDOW OPEN AND ONE CLOSED

New Steel Basement Sash for Houses

The accompanying illustrations show a new type of steel window frame and sash for basement windows which is being put on the market by the Truscon Steel Co., Youngstown, Ohio. It is the first of its type.

Each frame comes as a complete unit, with the sash already hinged and ready for the glass. It is hinged at the top and opens in, eliminating interference with the outside screen.

Compared with the standard grade of wood frames, the steel window admits 50% more light; is relatively indestructible; easy of operation under all weather conditions; has double contact weathering, making the window storm proof; hardware comes already attached, and consists of strong hinges and a durable lock; no fitting of sash to frame necessary; saving in cost over wood construction, actual comparisons of cost showing a saving of $2.00 or more for each window.

The frame is easily installed in any foundation wall of concrete, concrete block, brick, or stone. The sizes are standard and fit into walls of standard size blocks or bricks.

When wired glass is used, as shown in Fig. 1, the window is practically burglar proof. This installation is particularly desirable when the window opening is used in putting coal into the basement.

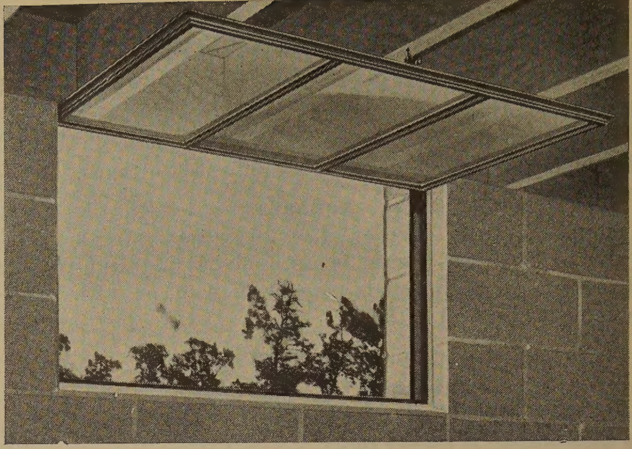


FIG. 2—INTERIOR VIEW OF BASEMENT, SHOWING SASH HINGED AT THE TOP, GIVING UNOBSTRUCTED OPENING

Report on Concrete House Construction

Report on Concrete House Construction is a particularly well conceived piece of promotional literature, which the architect will find handy to slip into his vertical files where it will be in plain sight when wanted. To make it still more handy, it is thumb-cut for each chapter as follows: The Advantage of Concrete Houses; Classification of Systems of Concrete House Construction; Detailed Data on Selected Systems of Construction; How to Make Good Concrete, Waterproofing, Dampproofing, and Insulating Concrete; Architectural Design Treatment in Concrete Houses; Exterior and Interior Wall Treatment; Floor and Roof Treatment; Best Methods of Handling Concrete in House Construction; Additional Sources of Information. This work is compiled and published by the Research Division of the Security Cement & Lime Co., Hagerstown, Md.

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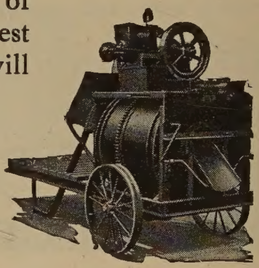

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